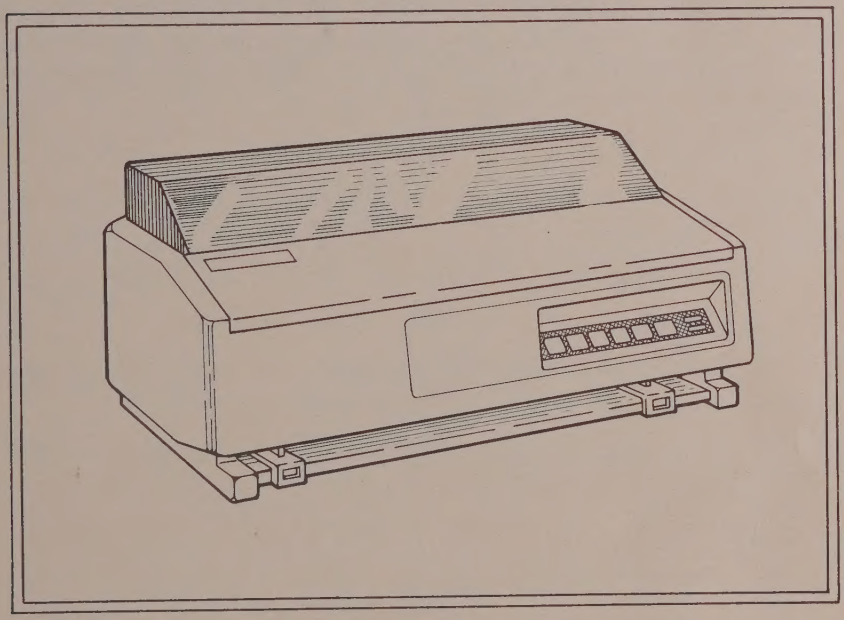
8070·PLUS



OPERATING · GUIDE

Dataproducts.

MP MASTER
MA25698

FCC APPROVAL

This printer generates and uses radio frequency energy. If not installed and used properly (i.e., in strict accordance with the manufacturer's instructions), it may cause interference to radio and television reception. It has been type tested, and does comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules. Operation of this equipment in a residential area may cause unacceptable interference to radio and TV reception requiring the operator to take whatever steps necessary to correct the interference.

The user is encouraged to try to correct any interference by one or more of the following methods:

- Relocate the printer with respect to the radio or television.
- Move the printer away from the radio or television.
- Plug the printer into a different outlet so that the printer and radio or television are on different branch circuits.
- If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions.

NOTE

This printer requires a shielded interface cable with a metal shell connector. Use of any other type of interface cable may cause radio and television interference.

8070·PLUS

OPERATING GUIDE

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Part No. 9000-008-316
August 1989
Edition E

SPECIAL NOTE TO USER

The purpose of the 8070 PLUS Operating Guide is to provide you with information on printer operation, including set-up, paper loading, setting of printer variables, and maintenance. Information on printer programming is covered in a separate 8070 PLUS Programming Guide (Part Number 9000-008-539), which is available through your dealer. The Programming guide offers generic explanations and sample programs for the control codes used by the printer.

Operation of the printer with your computer is not covered in this Guide, as operation is dependent on the computer and applications software package. Therefore, you should refer to the manuals that came with your computer and applications package for printing specifics.

This Operating Guide is provided for information purposes only. All information in this document is subject to change without notice. Dataproducts Corporation assumes no responsibility for any errors which may be contained within this document. Dataproducts Corporation assumes no responsibility or liability for injury or equipment damage while using this product. No part of the Operating Guide may be copied, disseminated or distributed without the express written consent of Dataproducts Corporation.

RELATED PUBLICATIONS

Title	Part Number
8070 Plus Operating Guide (Tri-lingual)	290713-001
8070 Plus Service Guide	9000-008-668

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(818) 887-8367 California only

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Contact your dealer/distributor

FOR WARRANTY AND NON-WARRANTY REPAIRS:

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East Coast RR&R Center
Route 13 South
Milford, NH 03055
(603) 673-9100

West Coast RR&R Center
9601 Lurline Avenue
Chatsworth, CA 91311
(818) 888-4007

When returning for repair, please include the following:

1. Bill and Ship-to Addresses
2. Proof of Purchase or Prior Repair
3. Purchase Order Number
4. Description of Problem
5. Contact Name and Phone Number
6. Method of Return Shipment

FOR SPARE PARTS AND MANUALS:

Call Customer Order Administration:
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ABOUT THE 8070 PLUS PRINTER

The Dataproducts Model 8070 PLUS Dot Matrix Printer can be used with most computers, including the IBM PC [tm] and its compatibles. The printer offers superior print quality throughout the full range of computer applications: word processing, business graphics, financial and business spreadsheets, data processing, and other applications.

The 8070 PLUS Printer offers two emulation modes: P-Series Compatible and IBM Compatible. The P-Series Compatible mode allows the printer to operate through your computer with software prepared for use with the Dataproducts P80 and P132 (IDS Prism Series) and 8050 and 8070 Series of Dot Matrix Printers, plus the IBM Color and Graphics Printers. The 8070 PLUS Printers can also be operated through your computer with most standard software packages.

With the 8070 PLUS Printer, you can intermix and print text and graphics, select several different type styles, sizes, and fonts, use special symbols, and format documents to meet your printing requirements. Selectable print format, high-resolution graphics, advanced paper handling, and multiple speeds allow you to produce high-speed draft quality output, typewriter quality correspondence, and letter quality reports and documents.

The 8070 PLUS Printer offers draft quality print at speeds up to 400 characters per second (cps), text quality print at speeds up to 300 cps, and letter quality print at speeds up to 100 cps.

The printer features a front control panel and selectable print menus, allowing easy printer setup to meet your printing needs. The printer is also fully programmable from your computer for even more versatility and flexibility.

As your application needs change, you can add low cost option modules without disrupting ongoing applications. Options presently available include color and automatic sheet feed.

[tm] IBM PC is a registered trademark of the International Business Machines Corporation.

ABOUT THIS OPERATING GUIDE

The Operating Guide is arranged in short sections that quickly show you how to set up and operate the printer. Here is what the Guide contains.

Section 1. Shows you what is packed with the printer, and explains how to remove the shipping restraints.

Section 2. Helps you set the printer up, select and connect the computer interface cable, and connect to AC power.

Section 3. Shows you how to turn the printer on, and introduces you to the printer's controls and operating modes.

Section 4. Shows you how to select and load pinfeed paper, initially set left and right margins, print a test pattern, and set top-of-form.

Section 5. Describes how to select and load single sheet paper, initially set left and right margins, and set top-of-form.

Section 6. Describes the printer parameter menus, and shows how to select and use the menus for your printing needs.

Section 7. Shows you how to clean your printer, and change a ribbon cartridge.

Section 8. Suggests things you can do if your printer does not operate properly. Includes fuse changing and left margin alignment procedures.

Appendices. Includes specifications, packing procedures, computer interfacing information, and procedures for selecting alternate power sources.

Index. Provides an alphabetic listing of all topics in this Operating Guide.

Operational Summary Chart. Summarizes on one tear sheet all operating and programming information for controlling the printer in both emulation modes.

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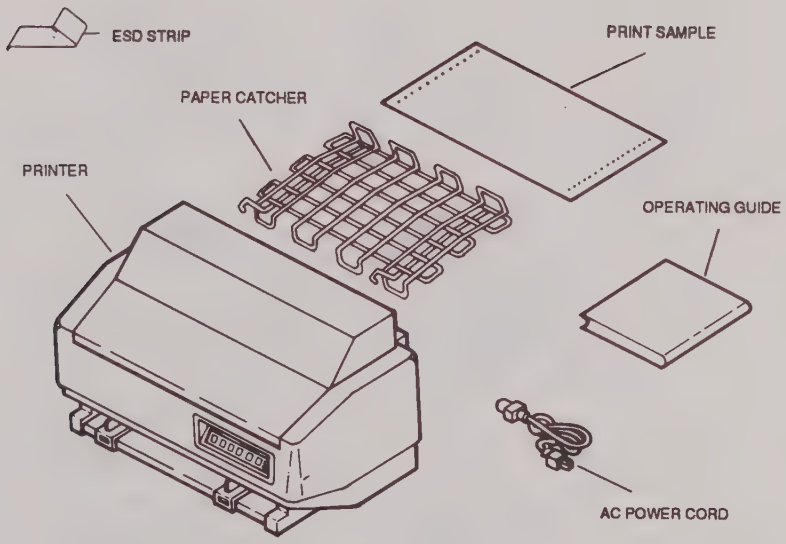
1 NOW THAT YOU HAVE UNPACKED

This section shows you:

- What items were shipped with the printer.
- How to remove all shipping restraints.

1 CHECKING THE CONTENTS



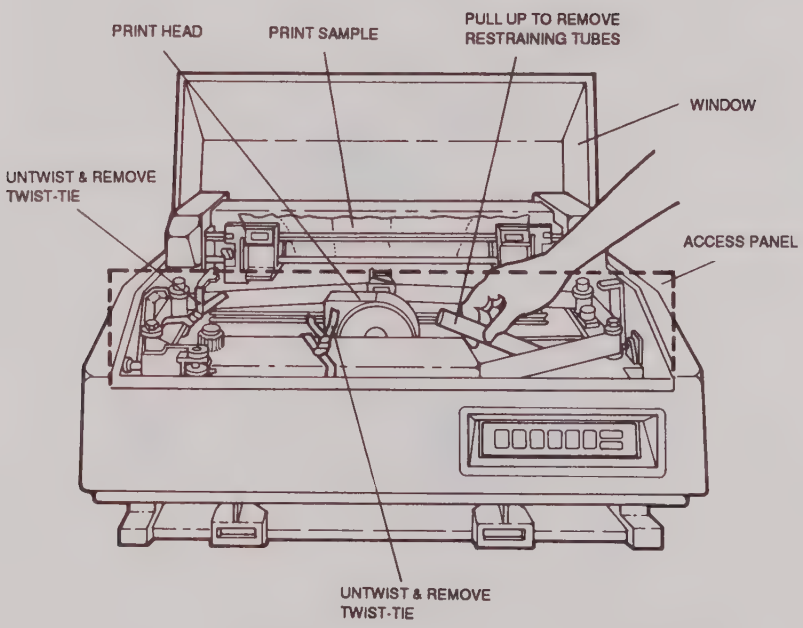
You probably have already unpacked the printer, and placed it on a table or desk. Now do the following:

1. Check that you have the parts shown above. The print sample is under the printer window.
2. Check that the printer is not damaged.

If you have missing parts or any damage, immediately contact your Dealer or shipping agent.

If you have not unpacked, follow the instructions on the shipping carton. Save the packing material for future storage of the printer. Appendix B includes packing procedures.

2 REMOVING SHIPPING RESTRAINTS



The printer has several shipping restraints that must be removed before beginning operation.

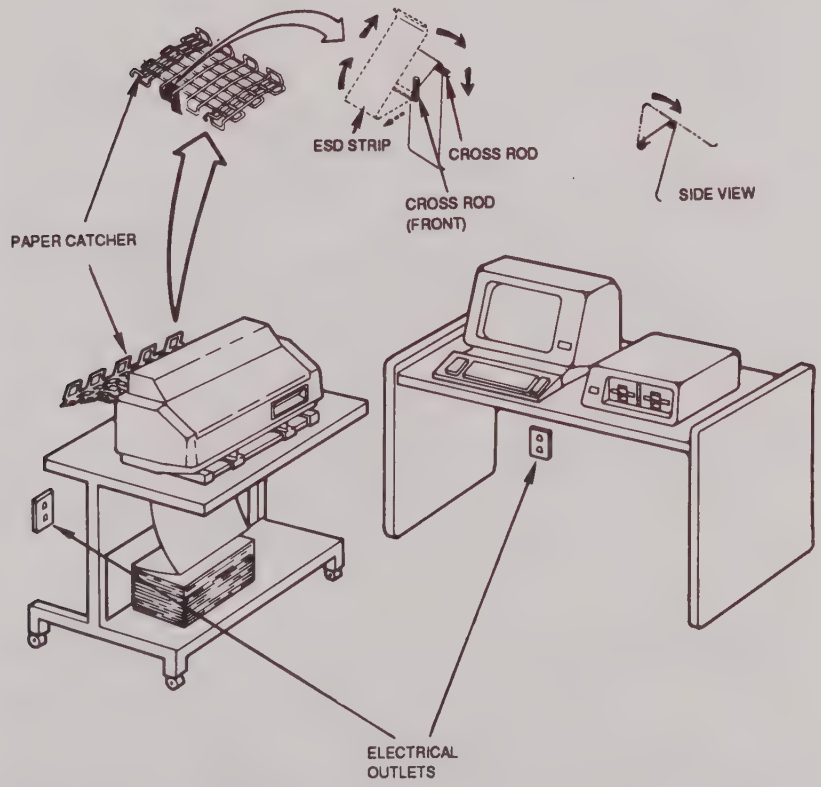
1. Open the printer window and access panel, in that order. If you haven't already, remove the print sample.
2. Remove the two twist-ties.
3. Remove the two print head cardboard restraining tubes.
4. Remove the protective plastic wrap from the window.
5. Close the access panel and window, in that order.

2 SETTING UP THE PRINTER

In this section, we explain how to:

- Set the printer up at your work station.
- Install the paper catcher.
- Select and connect the interface cable.
- Connect the AC power cable.

1 SETTING UP AT THE WORK AREA

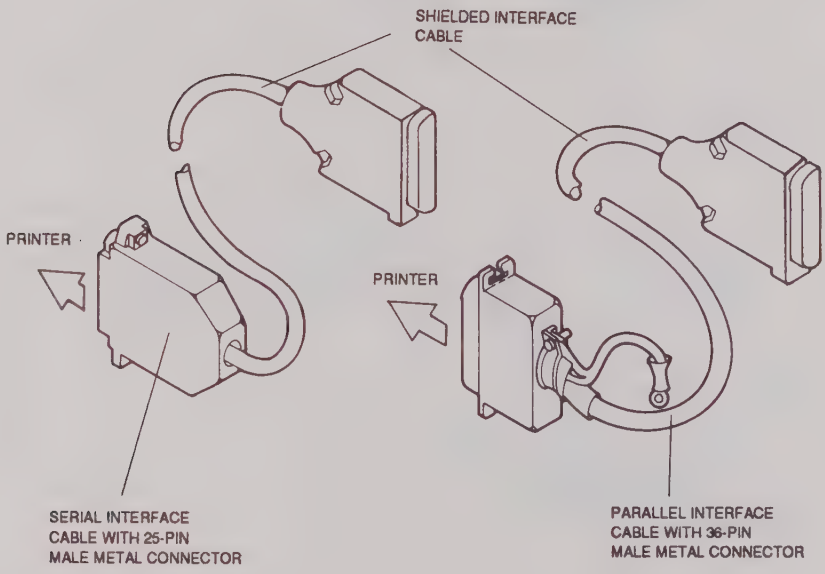


Set the printer on a work surface, near your computer and an electrical outlet.

Install the ESD strip on the paper catcher by snapping the short end over a front cross rod and pivoting the strip up and over the next cross rod as shown in the inset drawing.. Push down on the ESD strip until it is fully seated on the rod. If not completely seated the ESD strip could interfere with paper movement.

Install the paper catcher by inserting the two hooked ends of the catcher into the mounting holes on the back of the cover. Allow about 18 inches clearance behind the printer for the paper catcher. Allow space in front of the printer for access to the controls.

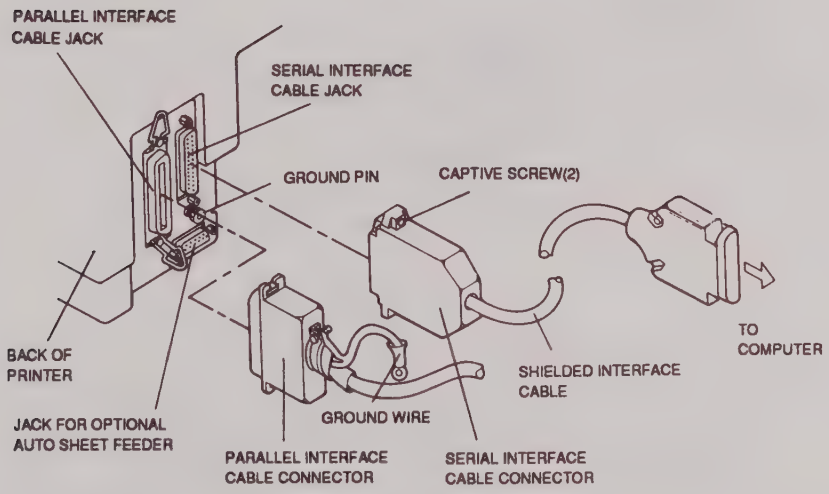
2 SELECTING THE PRINTER INTERFACE CABLE


SHIELDED INTERFACE CABLE
PRINTER
PRINTER
SERIAL INTERFACE CABLE WITH 25-PIN MALE METAL CONNECTOR
PARALLEL INTERFACE CABLE WITH 36-PIN MALE METAL CONNECTOR

The printer is connected to your computer through a parallel or serial shielded interface cable. The printer end of the cable must have a 25-pin connector for the serial interface or a 36-pin connector for the parallel interface.

Cable selection depends on your computer, as the printer accepts either parallel or serial data. Your dealer can help select the cable best suited for your installation. Or, you can determine cable requirements using the data in Appendix C.

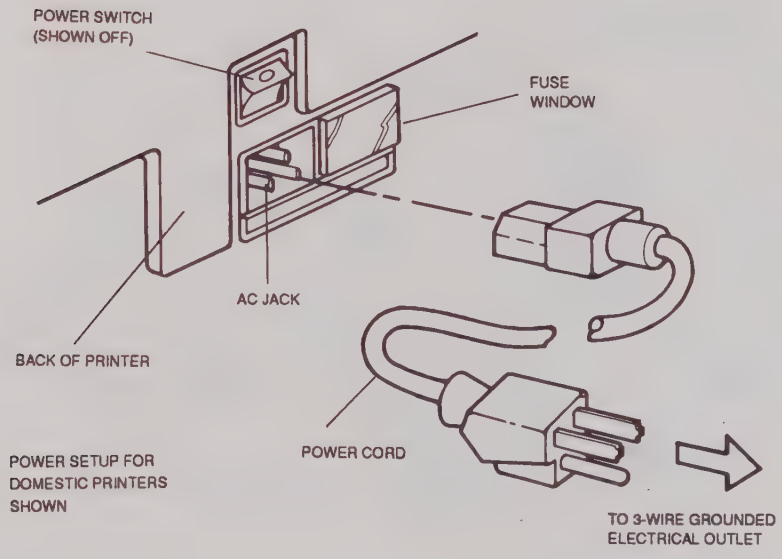
3 CONNECTING THE INTERFACE CABLE



Connect the interface cable as follows:

1. Identify the cable you are using (parallel or serial), then locate its jack on the back of the printer.
2. Match the cable connector to the appropriate jack, then plug it in.
3. For the parallel cable, snap the locking loops on the jack over the catches on the connector. Fasten the ground wire to the ground pin.
4. For the serial cable, fasten the connector to the jack with the captive screws.
5. Connect the other end of the cable to the computer.
6. Set the printer for either parallel or serial interface operation per the procedures in Section 6.

4 CONNECTING TO AC POWER



The printer is shipped set for 120 VAC operation. Connect AC power as follows. (If your power source is 100, 200 or 220 VAC, reset the printer per Appendix D.)

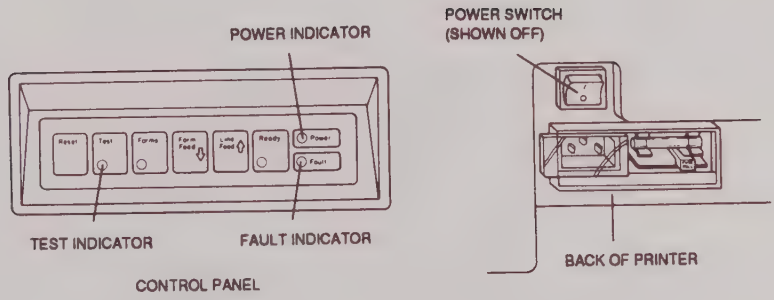
1. Locate the power switch, AC jack, and fuse window on the back of the printer.
2. Check that the power switch if Off and the AC jack is accessible. You may have to slide the fuse window to uncover the jack.
3. Firmly plug the power cord into the AC jack.
4. Plug the other end of the power cord into a 3-wire grounded AC power outlet.

3 TURNING THE PRINTER ON

This section includes:

- Printer turn-on procedures.
- An overview of the control panel and mechanical controls.
- A brief description of the modes of operation.

1 TURNING THE PRINTER ON

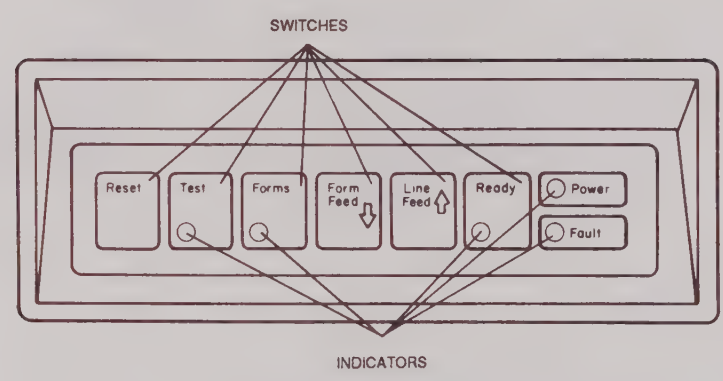


Turn the printer on and observe the following:

1. Press the power switch On. The control panel indicators will blink on and off.
2. The **POWER** indicator lights and a beep sounds, indicating that power is available.
3. The **TEST** indicator blinks on and off several times, then stays off and a beep sounds.
4. The printer will perform an internal self-test. If it passes, the print head will move to the left side in preparation for printing. If it fails to move left, the printer requires service.
5. After several seconds, the **FAULT** indicator will come on and three beeps will sound. This indicates that paper is not loaded in the printer. The indicator will go out when paper is loaded.
6. If you are finished, press the power switch Off. All indicators go out and a beep sounds.

While you are here, take a few minutes to briefly familiarize yourself with the printer's controls, indicators and operational modes. These are discussed on the following pages. Details of operation are covered in the appropriate sections of this Guide.

2 THE CONTROL PANEL



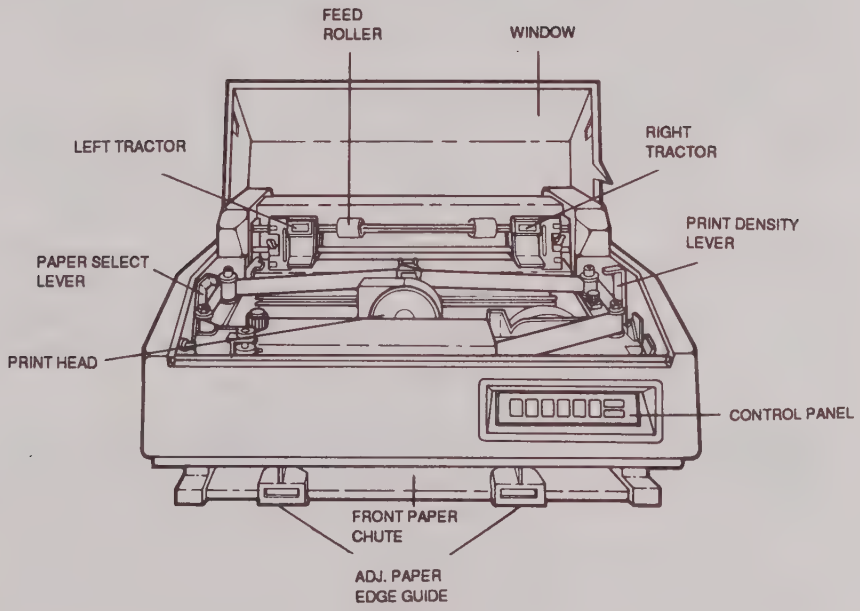
The control panel contains the switches and indicators for printer operation. All switches are touch sensitive, and are activated by light finger pressure. Each switch, when pressed in the correct sequence, will acknowledge your touch with a beep. The beep indicates that the switch is activated.

The **POWER** indicator, when on, indicates that the power switch is On and power is available. The **FAULT** indicator, when on, indicates that paper is not loaded. The indicator goes out when paper is loaded. A flashing **FAULT** indicator indicates that the printer has malfunctioned and must be serviced.

The **READY** switch/indicator connects your computer to the printer for data inputs or disconnects the computer to allow selection of printer functions from the panel. Pressing the switch On (indicator goes on) connects the computer. Pressing the switch Off (indicator goes off) disconnects the computer. A flashing **READY** indicator shows that the computer has disconnected the printer.

The **LINE FEED**, **FORM FEED** and **FORMS** switches control paper loading and selection of printer functions. The two-mode **TEST** switch/indicator either clears the printer's memory or prints a test pattern. The two-mode **RESET** switch either resets the printer or assists in parameter selection.

3 MECHANICAL CONTROLS



Open the window and access panel. Take a few minutes to look at the controls shown above, and briefly explained below. We will show you how to use the controls in the appropriate sections of this Guide.

The paper select lever allows you to choose single sheet paper feed or pinfeed paper feed. The front paper chute and adjustable paper edge guides are used for loading and guiding single sheet or pinfeed paper into the printer. The printer also has a rear paper chute and a bottom paper chute for loading pinfeed paper.

Two adjustable tractors and feed rollers hold paper in place during paper movement and printing. The print density lever darkens or lightens the print for maximum clarity, and adjusts the printer for different thicknesses of paper or forms.

4 MODES OF OPERATION

The printer has two basic operational modes for using the switches on the control panel. Each mode is initially set by the **READY** switch. For each mode of operation, the **POWER** indicator must be on, indicating that power is available to the printer, and the **FAULT** indicator must be off, indicating that paper is loaded.

The two operational modes are:

Mode 1 Printer electrically connected to your computer (**READY** indicator off), and ready to receive data from the computer. **FORM FEED** and **LINE FEED** functions can be performed in this mode.

Mode 2 Printer electrically disconnected from your computer (**READY** indicator off), and not ready to receive data from the computer. All switches are active for positioning paper, printing a test pattern, selecting printer operational parameters, setting top-of-form or clearing the printer's memory.

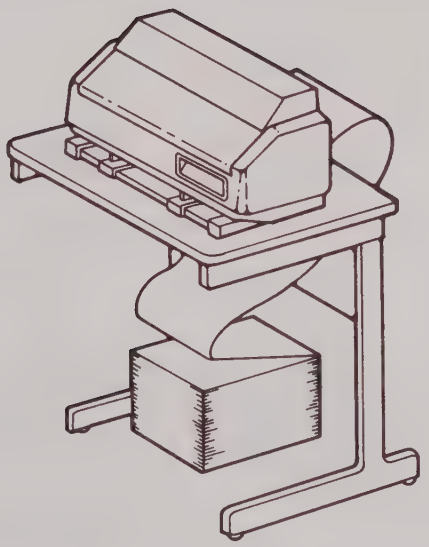
Keep in mind that the printer automatically selects **Mode 1** whenever the printer is turned on, as indicated by the lit **READY** indicator. **Mode 2** is selected by pressing the **READY** switch, and is indicated by the unlit **READY** indicator.

4 LOADING PINFEED PAPER

In this section, you will:

- See what types and sizes of pinfeed paper can be used.
- Learn how to load and center pinfeed paper.
- Print a test pattern of all printable characters, and adjust print density.
- Make initial margin settings.
- Position paper via line and form feeds.
- Set top-of-form.

1 THE PAPER

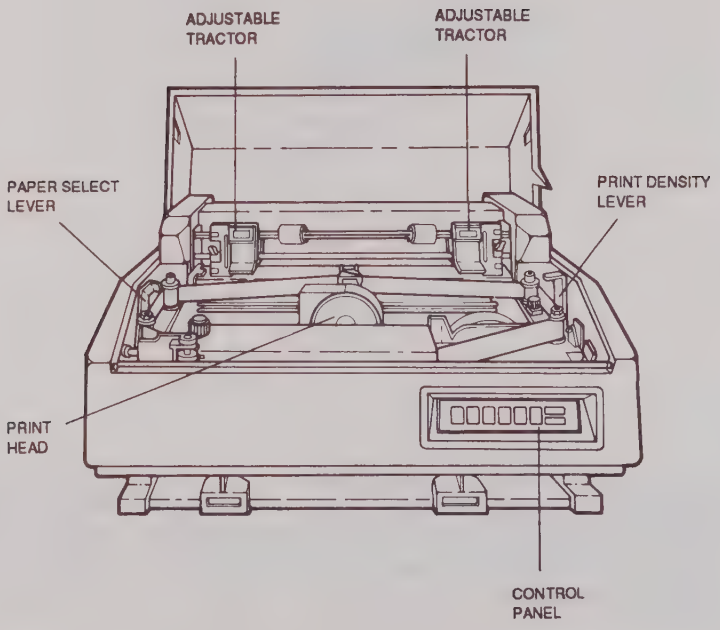


Pinfeed paper is normally loaded through the back of the printer but can also be loaded through the bottom or front. Once paper is properly loaded, the printer will position the paper to the first printable line. When printing is completed on the sheet, the printer will move the paper to the next sheet, again to the first printable line. This cycle continues for as long as the paper supply lasts.

The printer uses standard single-part pinfeed fanfold paper (15 to 20 lb) or up to six-part forms (12 to 15 lb paper and 6 to 8 lb carbons). You can use paper with widths ranging from 3 1/2 inches minimum to 14 7/8 inches maximum (including perforations), and all standard lengths.

Up to six-part forms may be used. However, five-part and six-part form operation should be tested prior to purchasing a printer or large supplies of forms due to variations in form thicknesses, folds, method of gluing, effects of humidity, etc. A maximum of four-part forms is recommended for optimum registration, feeding and stacking. All forms must be glued at the top edge, inspected for damage prior to usage, stored and used in low humidity environments, and without staples, tears, or wrinkles. Forms may be either continuous or cut forms, single-part or multi-part and carbon or carbonless.

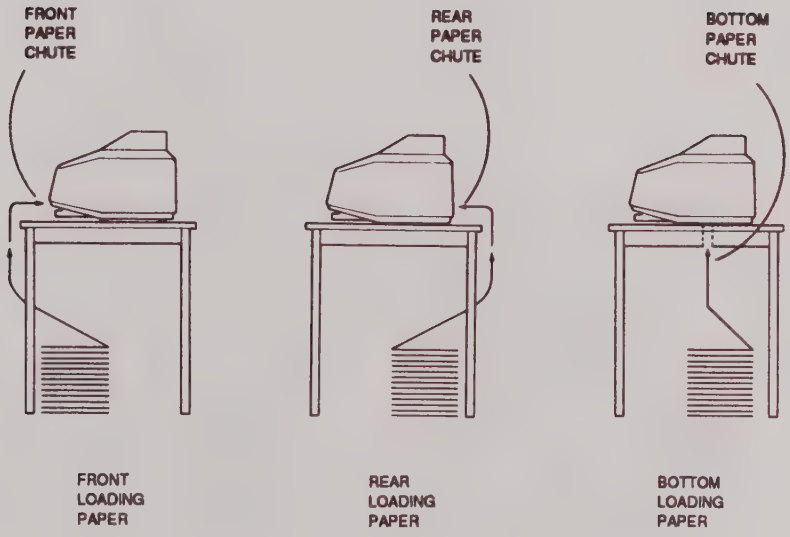
2 PAPER FEED CONTROLS



You will be loading pinfeed paper with the controls shown above. The paper select lever sets the printer for pinfeed paper feed. Pin belts in the two tractors move the paper through the printer, and hold the paper in position while printing. The print density lever darkens or lightens the print for maximum clarity, and adjusts the printer for different thicknesses of paper or forms. Control panel switches allow you to move the paper by line feeds, set top-of-form, and move paper to the next top-of-form.

How to use the controls to load pinfeed paper is explained in the following pages.

3 POSITIONING THE PAPER SUPPLY



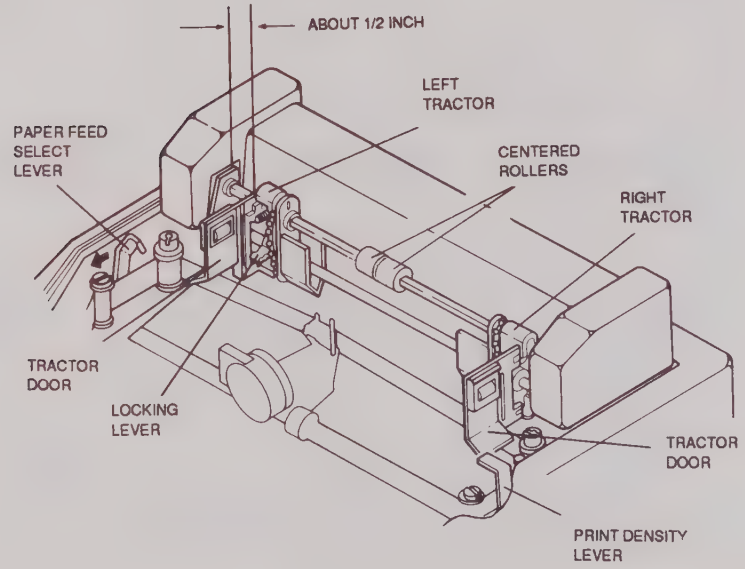
NOTE

A straight paper path provides optimum reverse paper movement.

You may load pinfeed paper through the rear paper chute, as shown above. Alternately, you may also load pinfeed paper through the bottom or front paper chutes. Whichever method of loading you choose, you should make the following adjustments. Making these adjustments will ensure that the printer moves each sheet of paper to the same position each time.

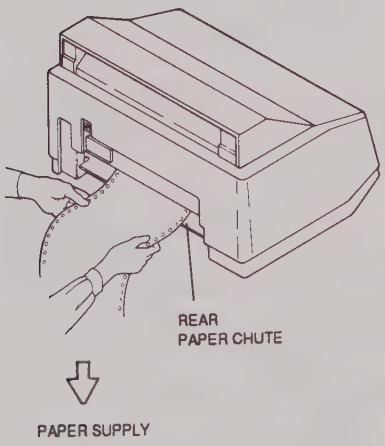
Once adjusted, you will not have to repeat them unless you change paper widths. For purposes of explanation, we will describe loading 14 7/8 inch wide pinfeed paper; loading other widths is similar.

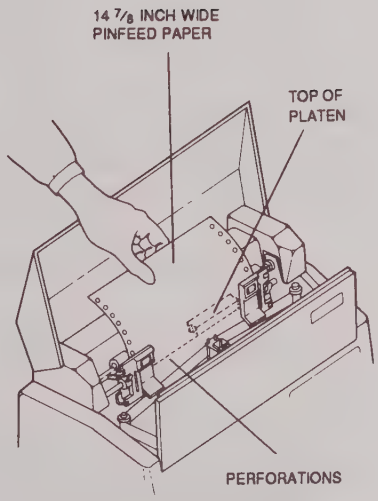
4 SET FEED AND DENSITY LEVERS, AND POSITION TRACTORS



1. Open the window and access panel, in that order. Position the paper feed select lever to the front of the printer to select pinfeed paper feed.
2. Position the print density lever halfway between full CLOSE and OPEN.
3. Unlock the left and right tractors by moving their locking levers down.
4. Open the tractor doors. Slide the tractors to their outermost positions.
5. Slide the two feed rollers to the center of the tractor shaft as shown.
6. Move the left tractor about 1/2-inch from the left-most position. Lock the tractor by moving the locking lever up.

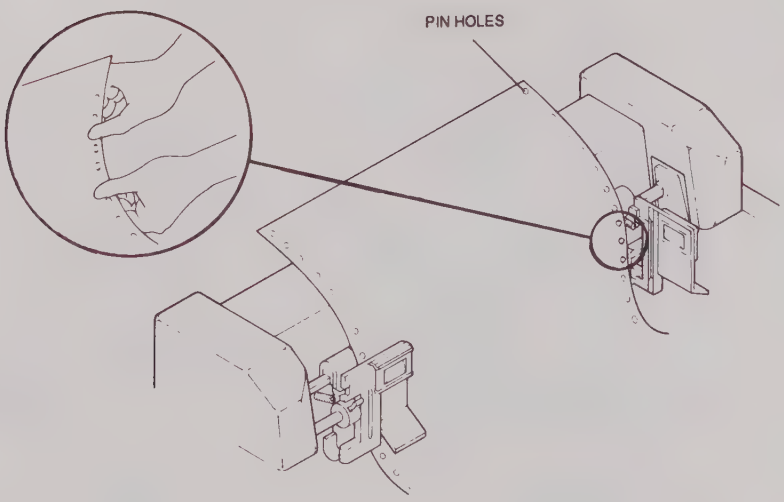
5 LOADING PINFEED PAPER





1. Place a supply of pinfeed paper on the table or floor behind the printer.
2. Insert the first sheet of paper through the rear paper chute. (If you are loading paper from the front, move the left and right paper guides to their outermost positions.)
3. Push the paper into the chute until it reaches the tractors.
4. Pull the paper up until the perforations at the bottom of the sheet are aligned with the top of the platen.

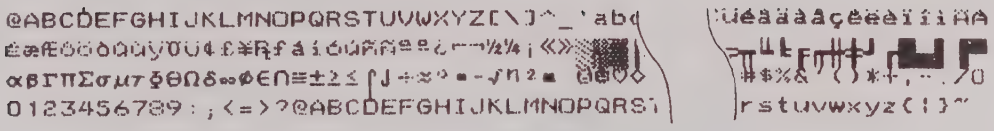
6 ALIGNING THE PAPER ON THE TRACTORS



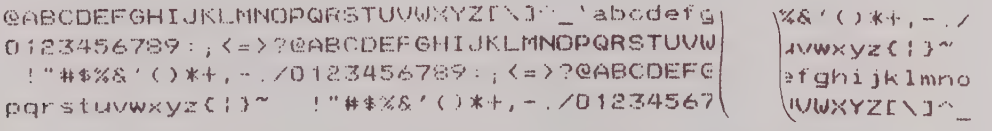
1. Place the paper feed pin holes on the left side of the paper over the pins on the left tractor pin belt. Close the left tractor door.
2. Slide the right tractor over to the pin holes on the right side of the paper. Place the pin holes over the pins on the tractor belt.
3. Check that the paper is evenly positioned on the pin belts, and not tipped to the right or left. Close the right tractor door.
4. Loosely pull the paper flat and then position the right tractor so that the pins are centered in the pin holes.
5. Lock the right tractor in place by moving its locking lever up.
6. Slide the paper under the window and out into the paper catcher. Close the access panel and window.

7 PRINTING A TEST PATTERN

IBM



P-SERIES



The printer's test function verifies printer operation and print quality by printing a rolling character pattern of all printable characters and block graphics, as shown above for the IBM emulation mode. (You can print a test pattern of all the P-Series printable characters by switching to the P-Series emulation as explained in Section 6.) Print the pattern as follows:

1. Press the power switch On. The **POWER** and **READY** indicators will come on.

2. Press **READY**. The **READY** indicator will go out, indicating that the printer is set to print the pattern.

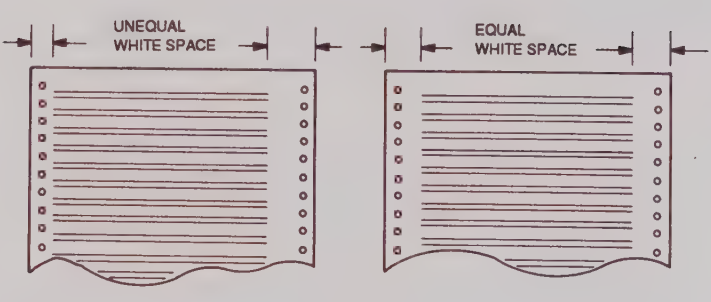
3. Press **TEST**. The **TEST** indicator will come on and, after a short delay, the test pattern will print. If the print goes off the paper, immediately press TEST to stop the printer and prevent damage to the print head. Adjust the tractors and paper. Restart the test.

4. While the pattern is printing, open the window to observe the print quality. If too dark, move the print density lever towards **OPEN**. If too light, move it towards **CLOSE**. To avoid excessive wear on the print head, do not move the lever all the way to **CLOSE**.

5. Press **TEST**. The **TEST** indicator will go out and, after printing another line, the printer will stop and stay off line. (Alternately, you can press **READY**. This immediately stops the printing, and places the printer in the **READY** mode.) Pressing **RESET** also stops the printing, but reinitializes the printer and makes the current print position the top-of-form.

6. Press **FORM FEED** to move the paper to the next sheet.

8 CENTERING PRINT ON THE PAPER



Centering print on the paper establishes initial left and right margins, and sets equal white space at the margins. Center the print as follows:

1. Print a test pattern by performing steps 1 through 5 above, under *Printing a Test Pattern.*
2. Press **FORM FEED** to move the paper to the next sheet.
3. Check the test pattern printout. If the white space is equal at the left and right margins, the print is centered.
4. If the printout is not centered, adjust the paper by unlocking and moving the tractors left or right as required. Print the test pattern; check for equal white space.

NOTE

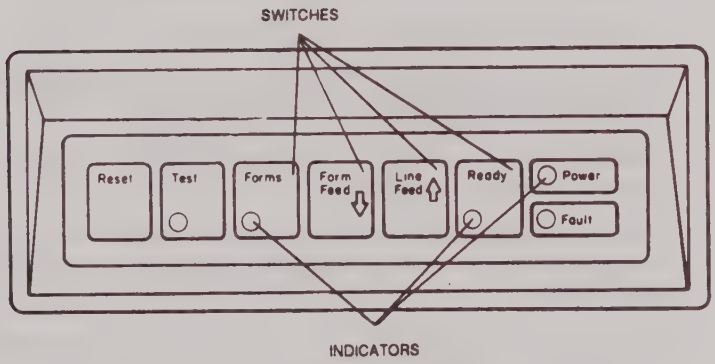
After changing to another paper width or character pitch, the print may not be centered. If needed, repeat this adjustment procedure.

5. Press **FORM FEED** to move the paper to the next sheet.

NOTE

FORM FEED can also be pressed to move to the next sheet of paper when the printer is on line and idle (carriage not moving).

9 POSITIONING PAPER THROUGH LINE OR FORM FEEDS



Control panel switches allow you to move paper up one or more full lines (line feeds) at a time or move paper to the next sheet of pinfeed paper (form feed), as you have already seen. For review, you may want to perform the following.

1. Check that pinfeed paper is loaded in the printer.
2. Check that the **READY** indicator is out or that the printer is idle. If not, press **READY** to set the printer off line or wait for the carriage to stop moving.
3. Press **LINE FEED** once. The paper will move up one full line.
4. Press and hold **LINE FEED**. The paper will continuously move up by line feeds until you release the switch.
5. Press **FORM FEED** to move an entire sheet of pinfeed paper through the printer to the next sheet. The paper will move to the first printable line on the next sheet.

10 SETTING TOP-OF-FORM

Setting top-of-form tells the printer you want each following sheet of paper to begin printing at the same vertical position as the last sheet. You may set top-of-form at any position by moving the paper up or down in 1/144 inch increments, and then "setting" the position. Do this as follows:

1. Check that pinfeed paper is loaded in the printer.
2. Check that the **READY** indicator is out. If not, press **READY** to set the printer for paper positioning.
3. Press **FORMS.** The **FORMS** indicator will come on, indicating that the printer is ready to set top-of-form.
4. Press and hold **LINE FEED** until the paper moves up to where you want to begin printing. If the paper requires moving down, press and hold **FORM FEED**.
5. Press **RESET**. The **FORMS** indicator will go out, indicating that you have set the new top-of-form position.

NOTE

If you press READY or FORMS instead of RESET, the top-of-form has not been changed. You must repeat steps 3, 4, and 5.

6. Press **FORM FEED**. The paper will move to the next sheet of pinfeed paper and stop where you set top-of-form.
7. Press READY to go on line.

Depending on your requirements, you can either go on to Section 5, *Loading Single Sheet Paper* or to Section 6, *Selecting Print Parameters,*

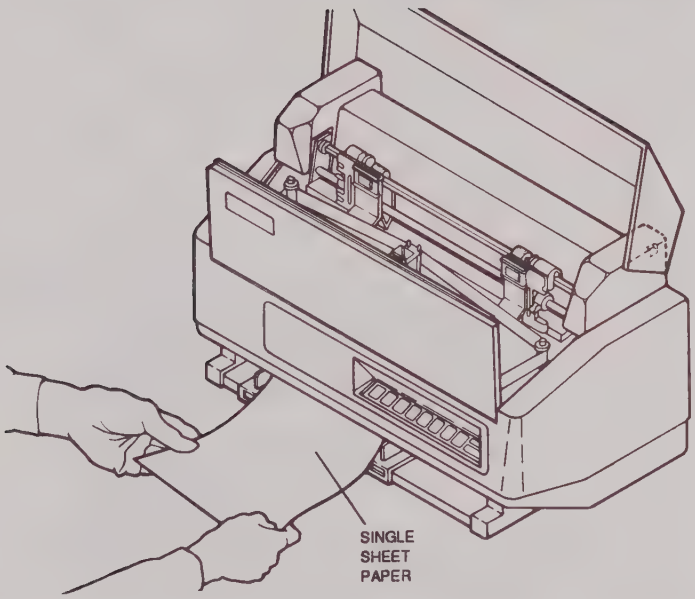
If you are going to load single sheet paper, remove all pinfeed paper from the printer. If you are going on to Section 6, we suggest you leave the pinfeed paper in the printer.

5 LOADING SINGLE SHEET PAPER

In this section, you will:

- See what types and sizes of single sheet paper can be used.
- Learn how to load and center single sheet paper.
- Make initial margin settings.
- Adjust for print density.
- Position paper via line and form feeds.
- Set top-of-form.

1 THE PAPER

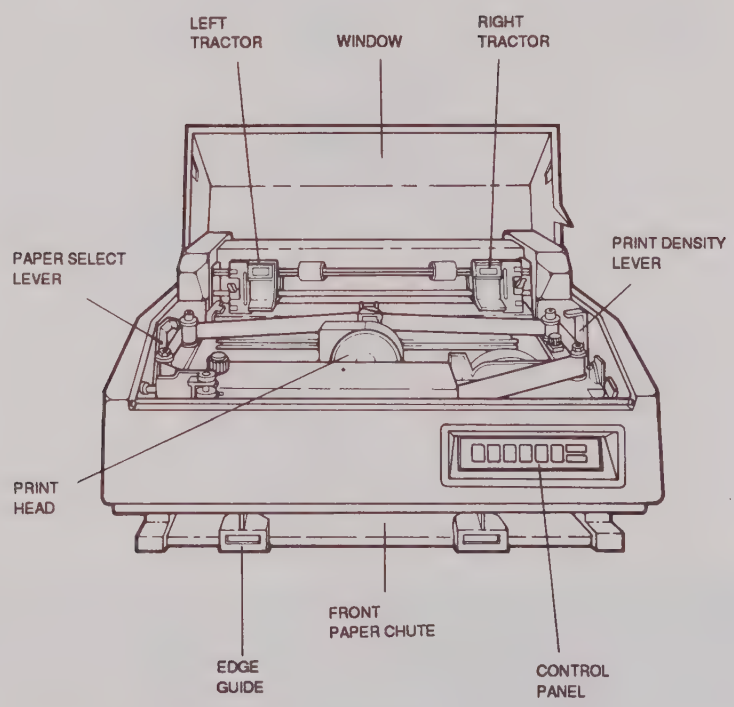


Single sheet paper is loaded into the printer from the front. Once the sheet is inserted (and power is on), the printer will automatically pick it up and move it to the first printable line. When printing is completed on the sheet, the printer will eject the sheet on your command. The printer will then automatically reset itself in preparation for insertion of the next sheet.

You can use 15 to 20 lb single sheet bond paper in the printer. Other thicknesses or forms must be tested in the printer for feed-through and print clarity. You can use paper with widths ranging from 7.0 inches minimum to 14 7/8 inches maximum, and any reasonable length 8 1/2 inches or over. Overhead transparency film designed for this printer may also be used, and is available from your dealer.

Up to six-part forms may be used. However, five-part and six-part form operation should be tested prior to purchasing a printer or large supplies of forms due to variations of form thicknesses, fold, method of gluing, effects of humidity, etc. A maximum of four-part forms is recommended for optimum registration, feeding and stacking.

2 PAPER FEED CONTROLS

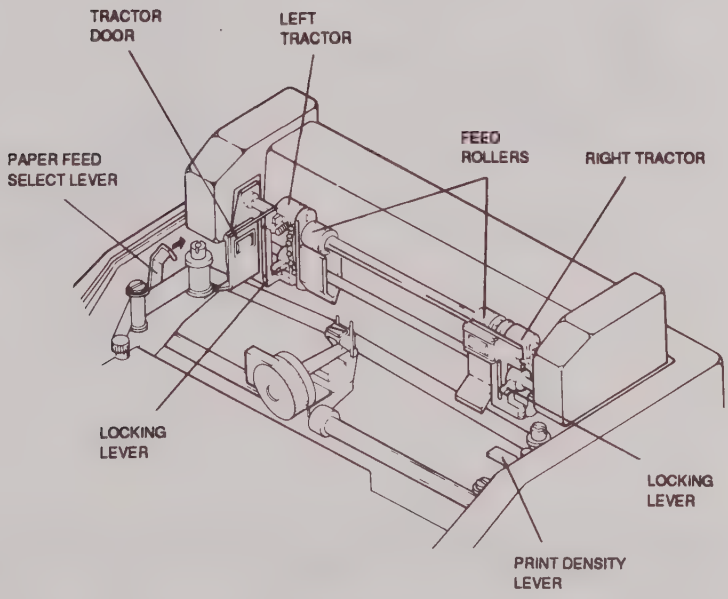


All forms must be glued at the top edge, inspected for damage prior to usage, stored and used in low humidity environments, and without staples, tears or wrinkles. Forms may be either continuous or cut forms, single-part or multi-part and carbon or carbonless.

You will be loading paper with the controls shown above. The paper select lever sets the printer for single sheet paper feed. The paper chute and edge guides guide single sheet paper into the printer. The two tractors hold the paper in position while printing. The print density lever darkens or lightens the print for maximum clarity. Control panel switches allow you to move the paper by line feeds, set top-of-form or eject paper.

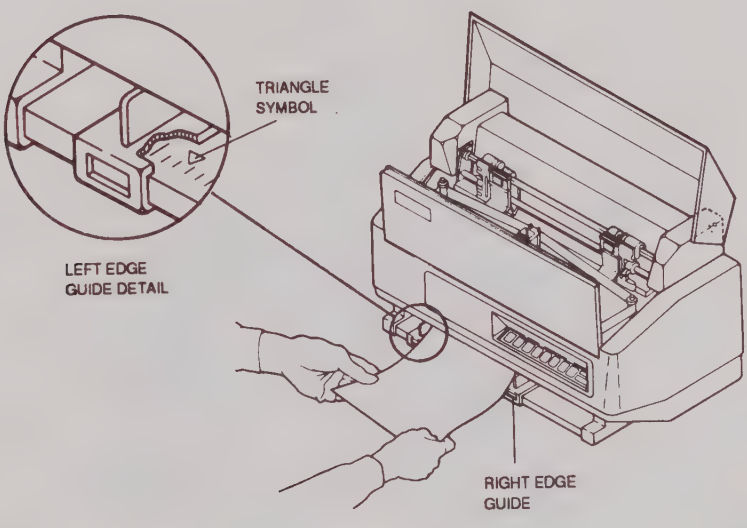
How to use the controls to load single sheet paper is explained next.

3 SET FEED AND DENSITY LEVERS, AND POSITION TRACTORS



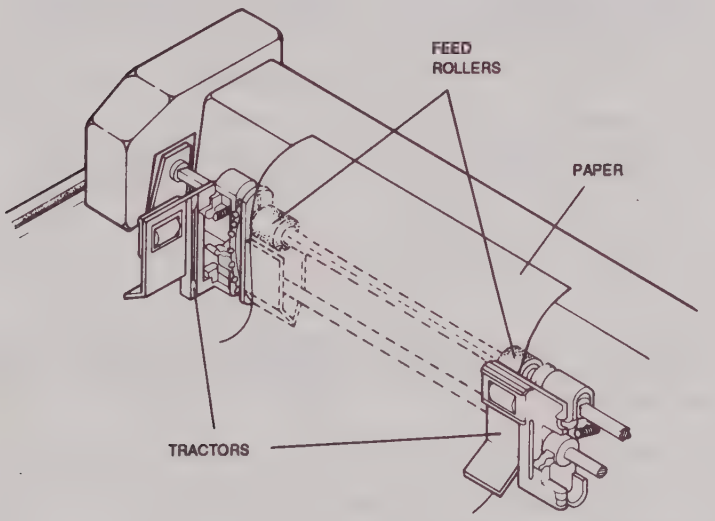
1. Open the window and access panel, in that order. Position the paper feed select lever to the back of the printer to select single sheet feed.
2. Position the print density lever halfway between full CLOSE and OPEN.
3. Unlock the left and right tractors by moving their locking levers down.
4. Open the tractor doors, then slide the tractors and feed rollers to their outermost positions.
5. Close the access panel; leave the window open.

4 SET PAPER GUIDES AND INSERT PAPER



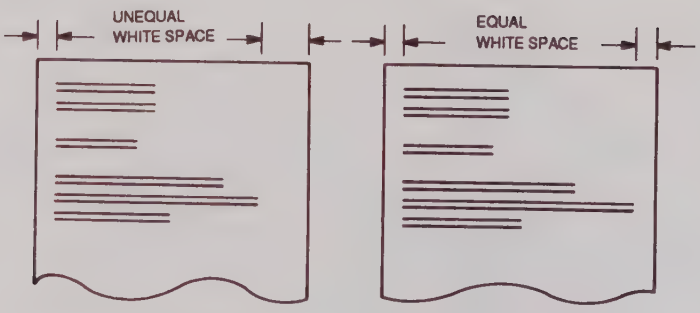
1. Slide the left paper guide to the triangle symbol. Slide the right guide to the right.
2. Slide a sheet of 8 ½ x 11 inch paper a quarter of the way into the paper chute, with the left edge of the paper against the left edge guide.
3. Slide the right paper guide up to the right edge of the paper but not touching.
4. Press the power switch On. The printer will perform its internal self-check, and the **POWER** and **FAULT** indicators will come on.
5. Slide the paper into the paper chute until it is picked up and fed to the first printable line.
6. The **FAULT** indicator will go out, indicating that paper is loaded. The **READY** indicator will come on.
7. Press **READY**. The **READY** indicator will go out, indicating that the printer is ready to position paper.

5 ALIGN THE PAPER WITH THE TRACTORS



1. Press and hold **LINE FEED** until the paper moves up between the tractors.
2. Slide each feed roller along the shaft until the outside edge of each roller is even with the paper edges. This position of the feed rollers and tractors is important for proper paper movement.
3. Slide each tractor up to its feed roller. Lock the tractors in place by pushing up on the locking levers. Close the tractor doors.
4. Press **FORM FEED** to eject the paper. The **FAULT** indicator will come on, indicating an out-of-paper condition.
5. Check the paper feed path by reinserting the paper into the paper chute until it is picked up by the printer and fed to the first printable line.
6. Press **FORM FEED** to eject the paper. The paper should move up through the tractors without jamming. If the paper jams, readjust the tractors and paper guides.

6 CENTERING PRINT ON THE PAPER



Centering print on the paper establishes initial left and right margins, and sets about even white space at the margins. Center the print on 8 ½ x 11 inch cut-sheet paper as follows:

1. Slide a sheet of paper into the paper chute until the printer picks it up.
2. Close the access panel and window.
3. Press **FORMS**. The **FORMS** indicator will come on.
4. Press **TEST**. The paper will automatically eject.
5. Wait for the **FAULT** indicator to come on, then insert the sheet of paper. The printer will move the paper to the first print line, then print six lines of data.
6. Press **RESET**. The printer will print a seventh line, then eject the paper.
7. If the print sample's white space is equal at the left and right margins, the print is centered. If not centered, readjust the tractors and paper guides.

NOTE

After changing paper width or character pitch, the print may not be centered. If needed, repeat this adjustment.

8. If the print density of the sample is too light, move the print adjust lever in the CLOSE direction. If too dark, move the lever in the OPEN direction. To avoid excessive wear on the print head, do not position the lever to fully CLOSE.

7 POSITIONING PAPER THROUGH LINE OR FORM FEEDS

Control panel switches allow you to move paper up one or more full lines (line feeds) at a time or a whole sheet of paper at a time (form feed), as you have already seen. For review, you may want to perform the following.

1. Load a sheet of paper into the printer.
2. Check that the **READY** indicator is out or that the printer is idle. If not, press **READY** to set the printer off line or wait for the carriage to stop moving.
3. Press **LINE FEED** once. The paper will move up one full line.
4. Press and hold **LINE FEED**. The paper will continuously move up by line feeds until you release the switch.
5. Press **FORM FEED** to eject the sheet of paper.

10 SETTING TOP-OF-FORM

Top-of-form for single sheet paper is set by parameter #7 (Top Margin). To set a termporary top-of-form for a single sheet, do the following:

1. Load a sheet of paper into the printer.
2. Check that the **READY** indicator is out. If not, press **READY** to set the printer for paper positioning.
3. Press **FORMS.** The **FORMS** indicator will come on, indicating that the printer is ready to set top-of-form.
4. Press and hold **LINE FEED** until the paper moves up to where you want to begin printing. If the paper requires moving down, press and hold **FORM FEED**.
5. Press **RESET**. The **FORMS** indicator will go out, indicating that you have set the temporary top-of-form position.

NOTE

If you press READY or FORMS instead of RESET, the top-of-form has not been changed. You must repeat steps 3, 4, and 5.

6. Press **FORM FEED** to eject the paper from the printer.
7. When you load another sheet of paper into the printer, it will automatically move to the first line of the sheet or to the top margin position set by parameter # 7.

NOTE

Instructions for printing a 132-column test pattern are given in Section 4, **Printing a Test Pattern**.

6 SELECTING PRINT PARAMETERS

This section introduces you to the printer parameter menus, and explains:

- What the menus are.
- What the print parameters are.
- How to select the proper menu for your computer.
- How to change and save print parameters.
- How to change and save interface parameters.

1 THE PRINTER PARAMETER MENU

The printer parameter menu allows you to select various print and operating functions to suit your printing and computer requirements. The menu parameters are variable, allowing you to set many of your printing tasks without having to program the printer. For example, through the menu, you can quickly set the printer for different character sets and pitches, print justified and proportionally spaced text, and set margins. The parameter tables at the end of this section explain each parameter, and describe the variable settings.

There are two basic parameter menus: IBM Compatible and P-Series Compatible. Each menu is shown on the following pages. Both menus are called up and modified from the control panel.

The IBM Compatible menu sets the printer to operate with software programs prepared for the Dataproducts 8051, 8052, 8071, and 8072 Printers, the IBM Color Graphics Printers, and most programs prepared for the IBM PC and IBM PC-compatible computers. The P-Series Compatible menu sets the printer to operate with software programs prepared for the Dataproducts P80 and P132 (IDS Prism Series) printers, the Dataproducts 8050 and 8070 printers, and most programs prepared for non-IBM computers.

Both menus have parameters for selecting parallel or serial interfaces. The printer is shipped set for the IBM parallel interface menu but can be reset for the P-Series menu, as explained later.

You can also program most of the parameters on the menus plus many additional functions. A listing of the programmable functions and their programming codes are at the back of this Guide. More comprehensive information on programming the printer can be found in Appendix E.

INFORMATION LINES

```
PRINTER SET-UP MODE
IBM COMPATIBLE

FIRMWARE LEVEL: 6A
```

SET-UP & INSTRUCTION LINES

```
#01  CHARACTER SET (1-254)..... 001
<READY>=MODIFY   <LF>=SCROLL   <FF>=JUMP   <FORMS>=SAVE ALL   <RESET>=EXIT
<TEST>=PRINT PARAMETER LIST
```

PARAMETER LINES

```
IBM COMPATIBLE
#01  CHARACTER SET (1-254)..... 001
#02  CHARS PER INCH (0=10, 1=12, 2=17.1)..... 0
#03  LEFT MARGIN (120'THS)..... 0000
#04  RIGHT MARGIN (120'THS: 960=8", 1584=13.2")..... 1584
#05  FORM LENGTH (144'THS: 1584=11", 1728=12")..... 1584
#06  AVAIL SPACE/FORM (144'THS: 1440=10", 1584=11").. 1584
#07  TOP MARGIN (144'THS: 144=1", 288=2")..... 0000
#08  VERT ADV-1 (144'THS: 24=6 LPI, 18=8 LPI)..... 0024
#09  AUTO LF ON CR..... OFF
#10  RIBBON AUTO SHIFT..... ON
#11  DOUBLE WIDTH..... OFF
#12  PROPORTIONAL SPACING..... OFF
#13  DOUBLE STRIKE..... OFF
#14  EMPHASIZED..... OFF
#15  JUSTIFY..... OFF
#16  BELL DURATION (0=OFF,1=NORMAL,15=1/2SEC) ..... 01
#17  ONE LINE BUFFER..... DISABLE
#18  IBM GRAPHICS/IBM COLOR..... COLOR
#19  ARGUMENT TYPE..... BINARY
#20  TABLE 1 (OFF)/TABLE 2 (ON)..... ON
#21  RESET MODE (SOFT OR HARD)..... SOFT
NOTE: CHANGES TO FOLLOWING PARAMETERS MUST BE SAVED
#22  COMPATIBILITY (0=P-SERIES, 1=IBM)..... 1
#23  INTERFACE..... PARALLEL
```

SET-UP & INSTRUCTION LINES

```
#01  CHARACTER SET (1-254)..... 001
<READY>=MODIFY   <LF>=SCROLL   <FF>=JUMP   <FORMS>=SAVE ALL   <RESET>=EXIT
<TEST>=PRINT PARAMETER LIST
```

EXIT LINE

```
EXIT FROM SET-UP MODE
```

INFORMATION LINES

```
PRINTER SET-UP MODE
P-SERIES COMPATIBLE

FIRMWARE LEVEL: 6A
```

SET-UP & INSTRUCTION LINES

```
#01  CHARACTER SET (1-254)..... 002
<READY>=MODIFY   <LF>=SCROLL   <FF>=JUMP   <FORMS>=SAVE ALL   <RESET>=EXIT
<TEST>=PRINT PARAMETER LIST
```

PARAMETER LINES

```
P-SERIES COMPATIBLE
#01  CHARACTER SET (1-254)..... 002
#02  CHARS PER INCH (0=10, 1=12, 2=17.1)..... 0
#03  LEFT MARGIN (120'THS)..... 0000
#04  RIGHT MARGIN (120'THS: 960=8", 1584=13.2")..... 1584
#05  FORM LENGTH (144'THS: 1584=11", 1728=12")..... 1584
#06  AVAIL SPACE/FORM (144'THS: 1440=10", 1584=11").. 1584
#07  TOP MARGIN (144'THS: 144=1", 288=2")..... 0000
#08  VERT ADV-1 (144'THS: 24=6 LPI, 18=8 LPI)..... 0024
#09  VERT ADV-2 (144'THS)..... 0012
#10  VERT ADV-3 (144'THS)..... -0012
#11  AUTO LF ON CR..... OFF
#12  RIBBON AUTO SHIFT..... ON
#13  DOUBLE WIDTH..... OFF
#14  PROPORTIONAL SPACING..... OFF
#15  DOUBLE STRIKE..... OFF
#16  EMPHASIZED..... OFF
#17  JUSTIFY..... OFF
#18  PAPER FEED INCREMENTS (48 OR 144)..... 48
#19  BELL DURATION (0=OFF,1=NORMAL,15=1/2SEC) ..... 01
#20  ONE LINE BUFFER..... DISABLE
#21  RESET MODE (SOFT OR HARD)..... SOFT
NOTE: CHANGES TO FOLLOWING PARAMETERS MUST BE SAVED
#22  EXTENDED CONTROL CODE SET..... ON
#23  COMPATIBILITY (0=P-SERIES, 1=IBM)..... 0
#24  INTERFACE..... PARALLEL
#25  DATA LENGTH (7- OR 8-BITS)..... 7
```

SET-UP & INSTRUCTION LINES

```
#01  CHARACTER SET (1-254)..... 002
<READY>=MODIFY   <LF>=SCROLL   <FF>=JUMP   <FORMS>=SAVE ALL   <RESET>=EXIT
<TEST>=PRINT PARAMETER LIST
```

EXIT LINE

```
EXIT FROM SET-UP MODE
```

2 UNDERSTANDING THE PARAMETER MENU

Look at the two parameter menus on the preceding pages. The top three lines on each menu are information lines. The first line shows that the printer is in the set-up mode. The second line shows what operating mode the printer is set for: IBM Compatible or P-Series Compatible. The third line shows the revision level of the printer's firmware.

The next three lines are used to enter the parameter set-up mode, and include the set-up line and two instruction lines. How to use these lines for set-up is explained later.

The block of parameter lines following the set-up lines identify each parameter. Each parameter line contains three entries. The first entry identifies the parameter with a two-digit number (for example, **#01**). The second identifies the parameter and its variable settings (for example, **CHARACTER SET (1-254)**. The third shows the current setting of the parameter (for example, **001**). Each parameter is explained in the parameter tables at the end of this section.

The last four lines duplicate the three parameter mode set-up and instruction lines, and include a fourth line showing the printer has left the parameter set-up mode. These lines are explained later.

3 SELECTING AND CHANGING PARAMETERS

You have a choice of two menus: IBM Compatible or P-Series Compatible. The printer is shipped set for the IBM parameter menu.

If you want to emulate P-Series printers, you must reset the printer for the P-Series parameter menu. Changing to the P-Series menu is explained in paragraph 8, *Selecting the IBM or P-Series Parameter Menu*.

For now, we suggest that you use the default IBM menu to see how to change parameters. The parameter change procedures described in the following pages are basically the same for either menu.

NOTE

We suggest that you perform the following procedures several times to become familiar with changing parameters. Then try experimenting with your own parameter changes. After finishing, you may want to change the parameter menu back to the factory set menu shown in the menu illustrations.

Up to now, you have used the control panel switches and indicators for loading and positioning paper. Now you will see how to use these same switches for an entirely different function -- that of selecting, changing and saving parameters on the parameter menu.

The parameter menu is called up and printed from the control panel through a set-up mode. Once in the set-up mode, the parameters can be changed and either temporarily or permanently saved through the control panel.

4 ENTERING THE SET-UP MODE

All parameter activity begins by entering the parameter set-up mode through the control panel. Do this as follows:

1. Ensure that paper is loaded, and that power is on. Pinfeed paper is preferred as you will be using several sheets.
2. Close the access panel and window.
3. Check that the **POWER** indicator is on, and the **READY** indicator off. If the **READY** indicator is on, press **READY.**
4. Press **FORMS**. The **FORMS** indicator will come on.
5. Press **TEST.** The **FORMS** indicator will go out. The printer will automatically move paper to the next sheet and print six lines of data. (If you are using single sheet paper, the paper will eject. Reinsert the paper. The printer will position the paper and print the six lines.)

NOTE

If a warning line is printed and the power-up factory default parameters are shown, the non-volatile RAM data has been corrupted. See Checksum error message, paragraph 10.

These lines are the parameter prompt. The first three lines verify that you have entered the parameter set-up mode and that the printer is ready to change parameters within the selected menu. The next three lines are the parameter set-up and instruction lines for changing parameters.

You can start changing parameters per the procedures in the next paragraph. However, you may find it helpful for the first few times you change parameters to have a current printed menu of parameters to refer to. If so,

1. Press **TEST**. The remainder of the parameter menu will print.

The printer will automatically place you back in the parameter set-up mode, as shown by the three set-up and instruction lines at the bottom of the menu.

5 CHANGING THE PARAMETERS

Open the printer window, and look at the three set-up and instruction lines on you menu printout. The first line is the parameter, and the second and third lines are the instructions for changing the parameter. Note that the parameter is **#01**. This parameter and the two instruction lines are automatically printed out whenever entering the set-up mode.

The bracketed words in the lines are the switches to be pressed to perform the associated function. For example, the first instruction on the second line is (**READY**) = **MODIFY**. This means that you must press the **READY** switch when you want to modify a parameter.

Now use the instruction lines to change a parameter. As parameter **#01** is already set-up, we will use it as an example to show how to change character set 001 to character set 002. As a refresher, you may want to review the parameter tables for a description of parameter **#01**.

1. You should still be in the set-up mode. If not, perform the steps in paragraph 4, *Entering the Set-up Mode.*

2. Observe the three set-up and instruction lines on the menu print-out. You will see parameter **#01** as the parameter ready to be changed.

3. Press **READY**. The printer will print out three new instruction lines. The lines are asking you to select three numbers corresponding to the character set you want to change to. We chose the 002 set, so we will enter those three numbers into the printer.

4. Press **FORMS**. As the print head (pointer) is already at 0 in the instruction line, the 0 is automatically entered when you press **FORMS**. This is the first number to be entered.

5. Press **FORMS.** Again, as the print head is already at 0 in the instruction line, the 0 is automatically entered when you press **FORMS**. This is the second number to be entered.

6. Press **LINE FEED** twice. The print head will move to 1 on the instruction line. If you go by 2, press **FORM FEED** to move the print head back to 2. (If you forget where you are while entering numbers, press **RESET** to abandon the operation. The printer will place you back at parameter **#01**.)

7. Press **FORMS**. This enters the third and last number. The printer will print out **002 ENTERED**, then print the parameter **#01** message (with 002 entered) and the two instruction lines. (If you entered an incorrect number, the printer will print an **OUT OF RANGE OR INVALID** message and place the printer back in the select digit mode.)

Now you have several options open to you, as shown by the instruction lines. You can modify the existing parameter by pressing **READY**, like you have already done. Or, you can sequentially scroll (move) through the menu by pressing **LINE FEED**, jump to another parameter by pressing **FORM FEED**, save the parameters just changed by pressing **FORMS**, exit the menu by pressing **RESET** or reprint the menu by pressing **TEST**.

For demonstration purposes, we will change another parameter further down the menu. Before you can change that parameter, though, you must first call it up through either a parameter jump or scroll routine. Do this as follows.

6 JUMPING TO A PARAMETER

You have already modified parameter **#01**. Now jump to parameter **#04** (Right Margin) and change the margin setting from a 13.2 inch wide margin (1584) to an 8 inch wide margin (0960). (Alternately, you could also sequentially scroll (move) to parameter **#04** by pressing **LINE FEED** three times.) As a refresher, you may want to review the parameter tables at the end of this section for a description of parameter **#04**.

1. You should still be in the set-up mode. If not, perform the steps in paragraph 4, **Entering The Set-up Mode.**

2. Look at the three set-up and instruction lines on the menu print-out. As before, you will see a parameter line and two instruction lines.

3. Press **FORM FEED**. The printer will print four new instruction lines. The instructions are asking you to select two numbers corresponding to the parameter you want to jump to. We chose #04, so those two numbers must be entered into the printer.

4. Press **FORMS**. This enters the number 0, as the print head was already at 0.

5. Press **LINE FEED** four times to move the print head to 4 on the instruction line. If you go by 4, press FORM FEED to move the print head back to 4. (If you forgot where you are while entering digits, press **RESET** to abandon the operation. The printer will put you back in set-up.)

6. Press **FORMS**. This enters the 4. The printer prints **04 ENTERED**, the parameter **#04** line, and two instruction lines.

7. Press **READY**. The printer will print three new instruction lines asking for four numbers corresponding to the margin you want to set. We chose an 8 inch margin (0960), so those numbers must be entered.

8. Enter 0960 by positioning the print head under each number with the **LINE FEED** switch, then pressing **FORMS** to enter each number.

9. After you enter the last number, the printer will print **0960 ENTERED**, the parameter **#04** line with the new setting (0960), and the two instruction lines.

Again, you have several options available to you, as shown on the instruction lines. Let's assume you are finished modifying parameters and want to print. Before you can do that, though, you must either temporarily or permanently save the parameters. This is explained next.

7 SAVING PARAMETERS

You can temporarily or permanently save parameters **#01** through **#21**. Note that parameters **#22** and up must be permanently saved; they cannot be temporarily saved. Temporarily saving a parameter allows you to change a parameter for a unique application, and then to change back to a standard parameter without going through the parameter change mode.

For example, you may have a standard application requiring U.S. draft print and a unique application for U.S. correspondence print. By temporarily changing to U.S. correspondence, you can quickly revert back to U.S. draft by either turning the printer off and back on or by pressing TEST, then RESET. However, keep in mind that when you do this, ALL temporarily saved parameters are lost and the printer reverts to the last saved parameters.

Permanently saving a parameter allows you to maintain a parameter for a standard application over a period of time. Turning the printer off will not lose the changed parameter, as it is held in memory by an internal self-charging battery.

Temporarily save a parameter as follows.

1. You should still be in the set-up mode and have changed your parameter(s). If not, perform the steps in paragraphs 5 and 6.
2. Press **RESET**. The printer will temporarily save the parameter(s) and exit the parameter set-up mode.
3. The printer will print **EXIT FROM SET-UP MODE** and **WARNING: CHANGES NOT PERMANENT!.** The printer will automatically move paper to the next sheet if using pinfeed or eject the sheet if using single sheet. The messages are reminders that you are out of the set-up mode and that all temporary parameter changes will be lost when the printer is turned off.
4. Press **READY** to place the printer on line with your computer. The printer can now receive and print data if paper is loaded.

Permanently save a parameter as follows.

1. Check that the **READY** indicator is out. If not, press **READY**.
2. Press **FORMS**, then **TEST** to enter the parameter set-up mode. If already in the set-up mode, do not perform this step.
3. Change your parameters per paragraphs 6 and 7 or save the parameters (**#01** and **#04**) you just changed.
4. Press **FORMS**. This tells the printer that all changed parameters must be permanently saved.
5. The printer will print **ALL PARAMETERS ARE NOW PERMANENT DEFAULTS**, indicating that the parameters are saved.
6. Press **RESET** to exit the parameter set-up mode. The printer will print **EXIT FROM SET-UP MODE**, and automatically move the paper to the next sheet if using pinfeed or eject the sheet if using single sheet.
7. Press **READY** to place the printer on line with the computer. The printer is ready to receive and print data, if paper is loaded.

8 SELECTING THE IBM OR P-SERIES PARAMETER MENU

The printer is shipped from the factory set for the IBM parallel interface parameter menu. If you are NOT using an IBM or IBM-compatible computer, then you should reset the printer for the P-Series parameter menu. If you change to an IBM-compatible or IBM computer at a later date, you will need to reset the printer for the IBM parameter menu. This is done as follows:

1. Ensure that paper is loaded, power is on, and the **READY** indicator off. If the **READY** indicator is on, press **READY**.
2. Close the access panel and window.
3. Press **FORMS**. The **FORMS** indicator will come on.
4. Press **TEST**. The **FORMS** indicator will go out, paper will move to the next sheet, and the printer will print six lines of data.

5. Check the second line of data to see what mode the printer is in.

NOTE

You must be in the correct compatibility emulation before changing any other parameters. The two menus are completely independent.

6. Jump to parameter **#22** (IBM Parameter Menu) or **#23** (P-Series Parameter Menu) and set the parameter as follows:

   - 0 if changing from IBM to the P-Series, or
   - 1 if changing from P-Series to IBM.

   You may want to refer to paragraphs 6 and 7 for a refresher on jumping to and changing parameters.

7. Press **FORMS** to save parameter **#22** or **#23.** This must be saved.

8. The printer will print **ALL PARAMETERS ARE NOW PERMANENT DEFAULTS** and **RESET PRINTER NOW IF COMPATIBILITY WAS CHANGED**.

9. Press **RESET**, press **READY** off, press **FORMS** on, and press TEST. The printer will print the first six lines of the parameter menu. The second line indicates the compatibility emulation.

10. Press TEST. The printer will print out the new parameters, and place the printer back in the set-up mode.

You can now modify any of the parameters on the menu or exit the set-up mode and resume printing. You may want to print the test pattern to see what printable characters are available in the selected mode. If so, exit the menu and run the print test Section 4.

9 CHANGING INTERFACE PARAMETERS

The printer was factory set for a parallel interface as shown by parameter **#23** (IBM menu) or parameter **#24** (P-Series menu).

Some computers or applications may require that the printer be set for a serial interface. Again, check your computer manual and/or software application manual to see what interface is required. If you need to operate with a serial interface, proceed per the following.

For the IBM parameter menu, change to the serial interface as follows.

1. Enter the parameter set-up mode and jump to parameter **#23** per paragraphs 5 and 7.
2. Press **READY** to change the parameter to SERIAL interface.
3. Press **TEST** to print the menu. Note that two new parameters are added to the bottom of the menu:

   #23 BAUD RATE (0=300, 1=1200, 2=2400, 3=4800, 4=9600)
   #24 PROTOCOL (XON/XOFF OR DTR)

4. Modify parameters **#23** and **24** to suit your application. Check your computer manual and/or software application manual to see what you need. Note that parity and data length cannot be selected for the IBM emulation. Parity is always NONE and data length is only 8-bits.
5. Press **FORMS** to save the parameters. These parameters must be saved.
6. Press **RESET** to exit the menu.
7. The printer will automatically go on line with the computer, as indicated by the lit **READY** indicator.

For the P-Series parameter menu, change to the serial interface as follows:

1. Enter the parameter set-up mode and jump to parameter **#24** per paragraph 4, *Entering The Set-up Menu*, and paragraph 7, *Jumping to a Parameter*.

2. Press **READY** to change the parameter to SERIAL interface.

3. Press **TEST** to print the menu. Note that three new parameters are added to the bottom of the menu:

   #26 BAUD RATE (0=300, 1=1200, 2=2400, 3=4800, 4=9600)
   #27 PARITY CHECK (0=OFF, 1=EVEN, 2=ODD)
   #28 PARITY POLARITY (SPACING OR MARKING)

4. Modify parameters **#26, 27** and **28** to suit your application. Check your computer manual and/or software application manual to see what you need. Note that this printer uses a 10-bit asynchronous frame only.

5. Press **FORMS** to save the parameters. These parameters must be saved.

6. Press **RESET** to exit the menu.

7. The printer will automatically go on line with the computer, as indicated by the lit **READY** indicator.

To change back to a parallel interface for either menu, repeat steps 1 through 3 and 5 through 7.

10 CHECKSUM ERROR MESSAGE

There may be times that a **WARNING:CHECKSUM ERROR IN PERMANENT RAM** message appears at the top of the parameter menu print-out. This means that all saved and stored parameter changes were lost, and the printer reverted to its factory set parameters. This may happen if the printer has been turned off for a long period of time. Avoid this by leaving the printer on for at least 20 hours in a 120 day period to maintain the printer's battery charge.

NOTE

Newer printer models have lithium battery modules that should retain the data for ten years even without the power being on.

If you receive the Checksum Error message, turn the printer on to recharge the printer's battery, reset the parameters, and save them. If the printer continues to print the Checksum Error message and the parameters cannot be saved, the battery has completely lost its charge and must be replaced. The printer should be returned to your dealer for battery replacement.

IBM PARAMETER MENU DESCRIPTION

Parameter No.	Description	Factory Setting
#01	CHARACTER SET (1-254)	.001
	001 = U.S. draft quality print. 002 = U.S. correspondence quality print. 003 = U.S. letter quality print. 102 = U.S. Turbo draft quality print.	
#02	CHARS PER INCH (0 = 10, 1 = 12, 2 = 17.1)	0
	0 = 10 pitch. 1 = 12 pitch. 2 = 17.1 pitch. With a line length of 13.2 inches; 10 cpi = 132 characters, 12 cpi = 158 characters, and 17.1 cpi = 225 characters. More characters per line are available when using proportional spacing.	
#03	LEFT MARGIN (120'THS)	0
	Sets left margin in 1/120 inch increments from left edge of printer.	
#04	RIGHT MARGIN (120'THS)	1584
	Sets right margin in 1/120th inch increments from left edge of printer. 8 inch = 960 increments. 13.2 inch = 1584 increments.	
#05	FORM LENGTH (144'THS: 1584 = 11", 1728 = 12")	1584
	1584 = form length of 11 inches. 1728 = form length of 12 inches. Other lengths may be set in 1/144 inch increments.	
#06	AVAIL SPACE/FORM(144'THS:1440 = 10",1584 = 11")	1584
	1584 prints within an 11 inch space on an 11 inch form. 1440 prints within a 10 inch space on an 11 inch form. Other print spaces may be set in 1/144 inch increments.	
#07	TOP MARGIN (144 = 1", 288 = 2")	0000
	0144 = 1 inch top margin. 0288 = 2 inch top margin. Other margins may be set in 1/144 inch increments. NOTE: This parameter sets the top margin for single (cut) sheet paper only.	

IBM PARAMETER MENU DESCRIPTION (Cont'd)

Parameter No.	Description	Factory Setting
#08	VERT ADV-1 (144'THS: 24 = 6 LPI, 18 = 8LPI) . . . . . 0024 0024 = vertical line feed of 6 lines per inch. 0018 = vertical line feed of 8 lines per inch. Other vertical advances may be set in 1/144 inch increments.	
#09	AUTO LF ON CR . . . . . OFF Off = no auto line feed on carriage return. On = auto line feed on carriage return.	
#10	RIBBON AUTO SHIFT . . . . . ON Off: disables automatic ribbon shift and is used with color capability. On: enables automatic ribbon shift for use with all-black ribbon, allowing automatic shift between all 4 bands to extend ribbon life. Band shifts at next top-of-form.	
#11	DOUBLE WIDTH . . . . . OFF Off = normal width characters. On = double width characters.	
#12	PROPORTIONAL SPACING . . . . . OFF Off = fixed spacing between characters. On = inter-character proportional spacing. May be used with justified printing to form text approaching book quality.	
#13	DOUBLE STRIKE . . . . . OFF Off = print head making single pass over characters. On = print head making two passes over characters with no horizontal or vertical offsets.	
#14	EMPHASIZED . . . . . OFF Off = print head making single pass over characters. On = print head over-printing characters with a 1/120 inch horizontal offset for bolding effect.	

IBM PARAMETER MENU DESCRIPTION (Cont'd)

Parameter No.	Description	Factory Setting
#15	JUSTIFY . . . . . Off = ragged right margin. On = square left and right margins. May be used with proportional spacing.	OFF
#16	*BELL DURATION (0 = OFF,1 = NORMAL,15 = 1/2SEC) . . . . . 01 to 60 causes the printer to emit an audible tone when the computer sends a CHR$(7) code or printer cannot load or detect the next form. Maximum tone length is about 2 seconds. 0 turns off the audible tone.	01
#17	*ONE LINE BUFFER . . . . . When disabled, the busy condition is held on only until the buffer can accommodate another full print line or while the printer is off line. When enabled, a CR, LF, or FF sets the busy condition until the printer stops because there is no more data.	DISABLE
#18	*IBM GRAPHICS/IBM COLOR . . . . . Color = set printer for IBM Color Printer software compatibility. Graphics = set printer for IBM Graphics Printer software compatibility.	COLOR
#19	ARGUMENT TYPE . . . . . Binary = set printer to binary mode of operation. ASCII = set printer to ASCII mode of operation.	BINARY
#20	TABLE 1(OFF)/TABLE 2(ON) . . . . . Selects either Table 2 character set or Table 1 character set.	ON
#21	RESET MODE (SOFT OR HARD) . . . . . Soft: when a cancel code is sent to printer, buffer clears and uses parameter set-up defaults. Hard: buffer clears when a cancel code is sent to printer. Soft is the normal setting.	SOFT

*Note that IBM parameters #16 to #18 and #22 to #25 cannot be altered by control codes.

IBM PARAMETER MENU DESCRIPTION (Cont'd)

Parameter No.	Description	Factory Setting
#22	*COMPATIBILITY (0 = P-SERIES, 1 = IBM) . . . . . 0 = Printer set for P-Series. 1 = Printer set for IBM.	.1
#23	*INTERFACE . . . . . Parallel = configuration for parallel interface. Serial = configuration for serial interface.	PARALLEL

NOTE

When parameter #23 is changed to SERIAL, the following two parameters are added to the parameter list.

#24	*BAUD (0 = 300,1 = 1200,2 = 2400,3 = 4800,4 = 9600)	.4
#25	*PROTOCOL (XON/XOFF OR DTR)	DTR

*Note that IBM parameters #16 to #18 and #22 to #25 cannot be altered by control codes.

P-SERIES PARAMETER MENU DESCRIPTION

Parameter No.	Description	Factory Setting
#01	CHARACTER SET (1-254)	.002

Alternate Settings

Character Set	Correspondence Quality	Draft Quality	Letter Quality	Turbo Draft
U.S.	001	002	101	102
English 1	003	004	103	104
English 2	005	006	105	106
French	007	008	107	108
Norwegian	009	010	109	110
German	011	012	111	112
Swedish	013	014	113	114
Spanish	015	016	115	116

#02 CHARS PER INCH (0 = 10, 1 = 12, 2 = 17.1) 0

0 = 10 pitch. 1 = 12 pitch. 2 = 17.1 pitch. With a line length of 13.2 inches; 10 cpi = 132 characters, 12 cpi = 158 characters, and 17.1 cpi = 225 characters. More characters per line are available when using proportional spacing.

#03 LEFT MARGIN (120'THS) 0000

Sets left margin in 1/120 inch increments from left edge of printer.

#04 RIGHT MARGIN (120'THS) 1584

Sets right margin in 1/120th inch increments from left edge of printer. 8 inch = 960 increments. 13.2 inch = 1584 increments.

#05 FORM LENGTH (144'THS: 1584 = 11", 1728 = 12") 1584

1584 = form length of 11 inches. 1728 = form length of 12 inches. Other lengths may be set in 1/144 inch increments.

P-SERIES PARAMETER MENU DESCRIPTION (CONT'D)

Parameter No.	Description	Factory Setting
#06	AVAIL SPACE/FORM(144'THS:1440 = 10",1584 = 11") . . . . . 1584 1584 prints within an 11 inch space on an 11 inch form. 1440 prints within a 10 inch space on an 11 inch form. Other print spaces may be set in 1/144 inch increments.	
#07	TOP MARGIN (144 = 1", 288 = 2") . . . . . 0000 0144 = 1 inch top margin. 0288 = 2 inch top margin. Other margins may be set in 1/144 inch increments.	
#08	VERT ADV-1 (144'THS: 24 = 6 LPI, 18 = 8LPI) . . . . . 0024 0024 = vertical line feed of 6 lines per inch. 0018 = vertical line feed of 8 lines per inch. Other vertical advances may be set in 1/144 inch increments.	
#09	VERT ADV-2 (144'THS) . . . . . 0012 0012 = vertical line feed up. Other line feeds can be set in 1/144 inch increments.	
#10	VERT ADV-3(144'THS) . . . . . -0012 -0012 = vertical line feed down. Other line feeds can be set in 1/144 inch increments.	
#11	*AUTO LF ON CR . . . . . OFF Off = no auto line feed on carriage return. On = auto line feed on carriage return.	
#12	RIBBON AUTO SHIFT . . . . . ON Off: disables automatic ribbon shift and is used with color capabilty. On: enables automatic ribbon shift for use with all-black ribbon, allowing automatic shift between all 4 bands to extend ribbon life. Band shifts at next top-of-form.	

*Note that P-Series parameter #11 cannot be altered by control codes.

P-SERIES PARAMETER MENU DESCRIPTION (CONT'D)

Parameter No.	Description	Factory Setting
#13	DOUBLE WIDTH . . . . . Off = normal width characters. On = double width characters.	OFF
#14	PROPORTIONAL SPACING . . . . . Off = fixed spacing between characters. On = inter-character proportional spacing. May be used with justified printing to form text approaching book quality.	OFF
#15	DOUBLE STRIKE . . . . . Off = print head making single pass over characters. On = print head making two passes over characters with no horizontal or vertical offsets.	OFF
#16	EMPHASIZED . . . . . Off = print head making single pass over characters. On = print head over-printing characters with a 1/120 inch horizontal offset for bolding effect.	OFF
#17	JUSTIFY . . . . . Off = ragged right margin. On = square left and right margins. May be used with proportional spacing.	OFF
#18	PAPER FEED INCREMENTS (48 OR 144) . . . . . 48 = 1/48 inch paper feed increments for use when changing paper feed commands through software. 144 = 1/144 inch paper feed increments, also for use with software. (Refer to the Programming Guide (P/N 9000-008-539) for details.)	48
#19	*BELL DURATION (0 = OFF, 1 = NORMAL, 15 = 1/2SEC) . . . . . 0 to 60 causes the printer to emit an audible tone when the computer sends a CHR$(7) code or printer cannot load or detect the next form. Maximum tone length is about 2 seconds. Zero turns off the audible tone.	01

*Note that P-Series parameter #19 cannot be altered by control codes.

P-SERIES PARAMETER MENU DESCRIPTION (CONT'D)

Parameter No.	Description	Factory Setting
#20	*ONE LINE BUFFER When disabled, busy condition is held on only until the buffer can accommodate another full print line or while the printer is off line. When enabled, a CR, LF, or FF sets the busy condition until the printer stops because it has run out of data.	DISABLE
#21	RESET MODE (SOFT OR HARD) Soft:when a cancel code is sent to printer, buffer clears and uses parameter set-up defaults. Hard: buffer clears when a cancel code is sent to printer. Soft is the normal setting.	SOFT
#22	*EXTENDED CONTROL CODE SET On enables expanded software control functions. Off disables expanded software control functions.	ON
#23	*COMPATIBILITY (0 = P-SERIES, 1 = IBM) 0 = Printer set for P-Series. 1 = Printer set for IBM.	.0
#24	*INTERFACE Parallel = configuration for parallel interface. Serial = configuration for serial interface.	PARALLEL
#25	*DATA LENGTH (7- OR 8-BITS) 7 = 7-bit data. 8 = 8-bit data.	.7

NOTE

When parameter #24 is changed to SERIAL, the following three parameters are added to the parameter list.

#26	*BAUD (0 = 300,1 = 1200,2 = 2400,3 = 4800,4 = 9600)	.4
#27	*PARITY CHECK (0 = OFF, 1 = EVEN, 2 = ODD)	.0
#28	*PARITY POLARITY (SPACING OR MARKING)	MARKING

*Note that parameters #20 and #22 to 28 cannot be altered by control codes.

7 TAKING CARE OF THE PRINTER

This section shows you:

- How to clean your printer.
- How to change the ribbon cartridge.

1 PRINTER CARE

The printer is designed for easy care. Other than occasional cleaning and ribbon cartridge replacement, the printer does not require any maintenance or removal of the cover for any reason. There are no lubrication requirements.

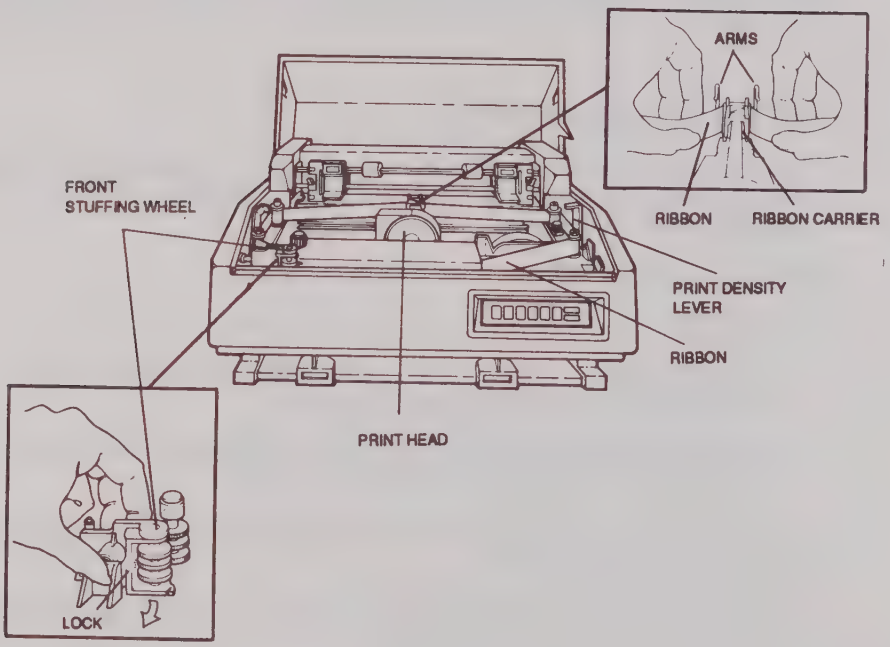
2 CLEANING THE PRINTER

The outside of the printer is cleaned as necessary. The paper feed and ribbon paths should be cleaned when changing a ribbon cartridge or if there is a build-up of dust, ink deposits or paper deposits.

Clean the printer as follows.

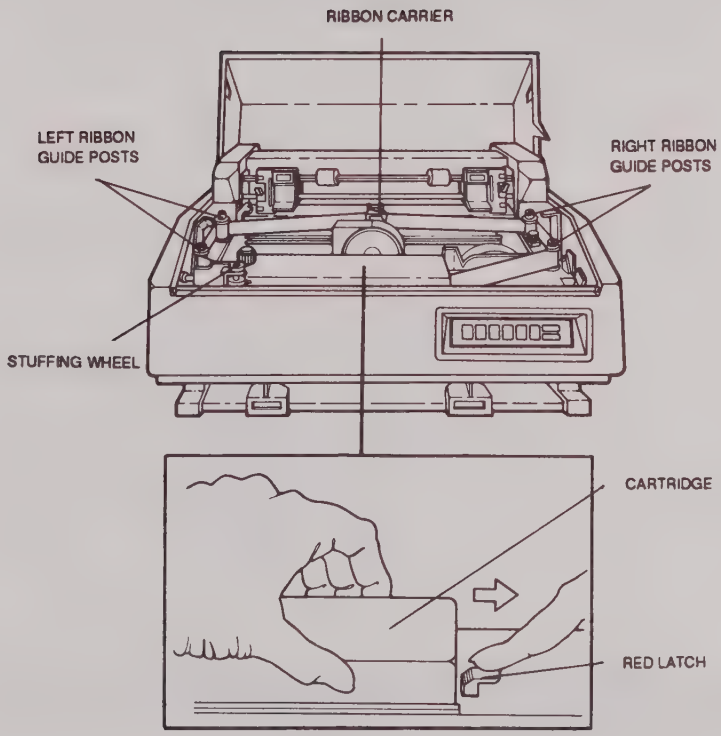
1. Press the power switch Off. Unplug the power cord.
2. Clean the cover and access panel with a mild detergent and lint-free cloth. Do not spill detergent into the printer.
3. Clean the window with a soft lint-free cloth moistened with commercial glass cleaner. Do not spill cleaner into the printer.
4. Remove dust, ink deposits and paper deposits from around the paper path with a lint-free cloth.
5. Remove heavy accumulations of dust or paper deposits by carefully blowing them out with a small vacuum cleaner.
6. Plug in the power cord. Press the power switch On.

3 REMOVING THE RIBBON CARTRIDGE



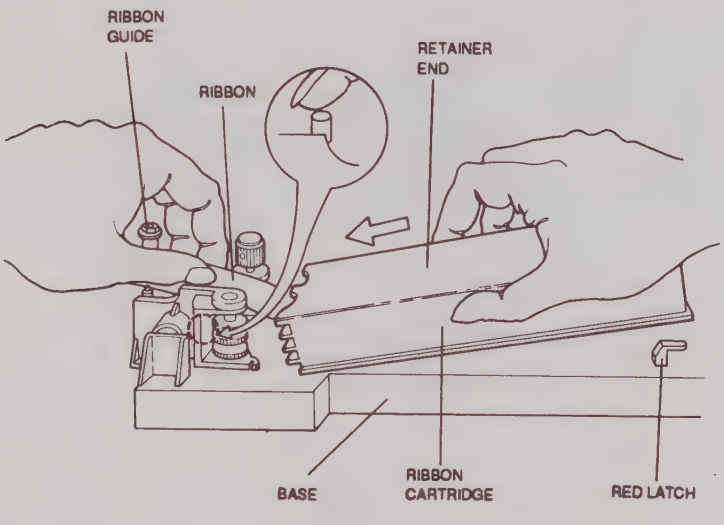
Ribbon is supplied in a snap-in cartridge for easy replacement. Replace the cartridge as follows.

1. Remove all paper from the printer.
2. Press the power switch Off. Open the window and access panel.
3. Center the print head on its shaft, and position the print density lever to full OPEN.
4. Push the ribbon down to clear the arms on the print head ribbon carrier. Pull the ribbon slightly forward and up, past the carrier.
5. Open the ribbon stuffing wheels by pivoting the front stuffing wheel towards the front of the printer until it locks in place.



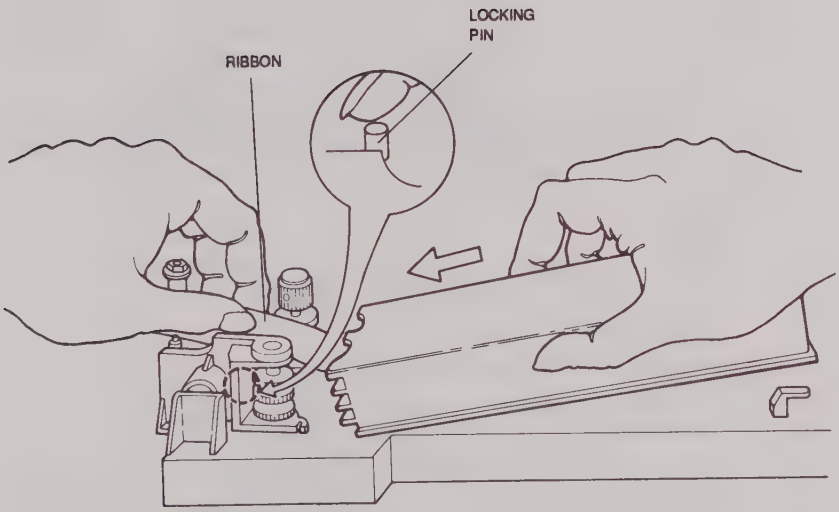
6. Slide the ribbon off the left and right ribbon guide posts.
7. Press down on the red locking latch, then slide the cartridge over the latch to the right.
8. Take the cartridge out of the printer and discard.
9. Use a lint-free tissue or cotton-tipped swab moistened with commercial window cleaner to clean around the stuffing wheels, ribbon guide posts, and ribbon carrier. Do not spill cleaner into the printer.

4 INSTALLING THE RIBBON CARTRIDGE

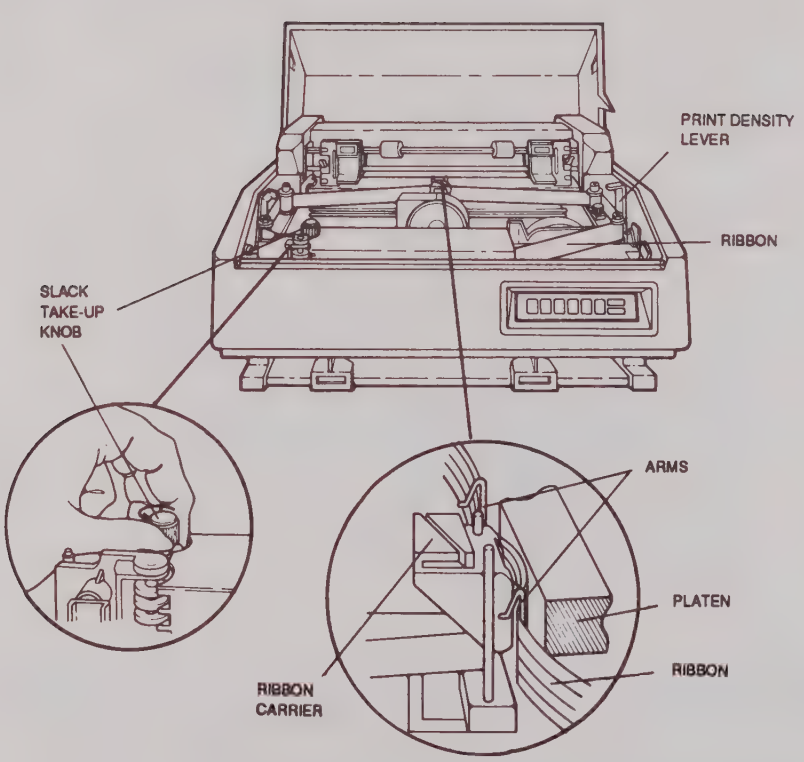


Use an authorized ribbon cartridge for replacement. Use of a non-authorized cartridge will decrease the life of the print head and void the warranty. Install the cartridge as follows.

1. Remove the cartridge from its box and unwrap it. Hold the cartridge with the cardboard retainer end upright.
2. Remove and discard the retainer. Hold the cartridge upright to prevent ribbon from spilling out.
3. Align the retainer end with the ribbon stuffing wheels. Set the cartridge on the cartridge base, with the right end of the cartridge over the red latch.
4. Thread the ribbon between the stuffing wheels, and around the ribbon guide.
5. Push down on the cartridge and slide it toward the stuffing wheels until the cartridge locks in place.



6. Check that there are no folds or twists in the ribbon where it passes between the stuffing wheels.
7. Close the stuffing wheels on the ribbon by pushing down on the locking pin.
8. Carefully pull about ten inches of ribbon from the opposite end of the cartridge.
9. Guide the ribbon around the left and right ribbon posts.
10. Check that there are no folds or twists in the ribbon path.



11. Slide the ribbon down between the ribbon carrier and platen, and then up under the arms of the carrier.

12. Remove ribbon slack by turning the slack take-up knob in the direction indicated by the arrow on the knob.

13. Check that the ribbon is around all ribbon posts and that there are no folds or twists in the ribbon.

14. Position the print density lever to its operating position.

15. Close the access panel and window. Press the power switch On.

8 IF YOU HAVE PROBLEMS

In this section, you will see:

- What to check for if the printer does not function properly.
- How to replace the AC line power fuse.
- How to align the left margin characters.

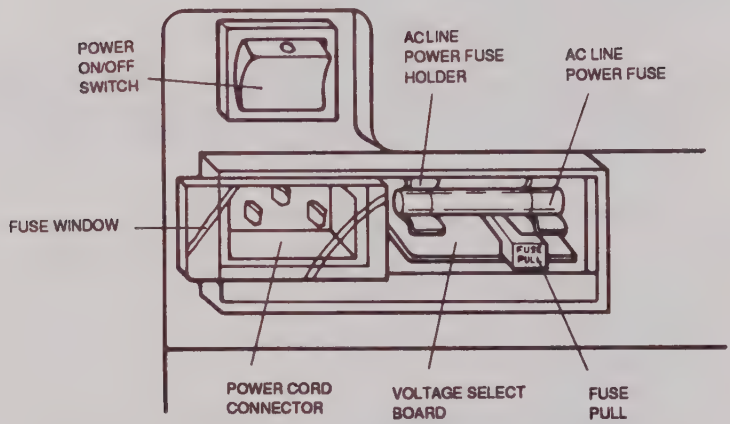
1 IF PROBLEMS OCCUR

Your printer is designed to be practically problem free. However, there may be times when the printer does not operate properly, either through operator error or printer malfunction. If your printer is not operating properly, check the following before calling for service.

1. Are the power switch and **POWER** indicator on?
2. Is the AC power cord properly connected to the power outlet, and is there power at the outlet? If the **POWER** indicator still does not come on, check the printer's fuse. (See paragraph 2, *Changing the Fuse* in this section.)
3. Is paper properly loaded, and the **FAULT** indicator out?
4. Is the **FAULT** indicator flashing? If so, turn off the printer and contact your Authorized Service Center.
5. Is the printer configured for your operating voltage? If in doubt, see Appendix D.
6. Do you have the correct interface cable, and is it properly connected? Is it solidly seated in its jack?
7. Have you set the printer for the interface (parallel or serial) desired? If in doubt, see *Changing Interface Parameters*, Section 6.
8. Have you correctly set the paper feed select lever?
9. Have you correctly set the print density lever?
10. Are your parameters set right? Are they set to perform the intended functions or have any been changed?
11. Have you selected the correct parameter menu (IBM Compatible or P-Series Compatible)? If in doubt, see *Selecting the IBM or P-Series Parameter Menu*, Section 6.
12. If the left margin characters are not vertically aligned, realign per *Aligning Left Margin Characters* in this section.

If the printer still does not operate correctly or not at all, contact your Service Center.

2 CHANGING THE FUSE



The printer contains one AC power fuse on the back. Turn the printer around, then change the fuse as follows.

1. Press the power switch Off. Unplug the power cord from the outlet and printer.
2. Slide the fuse window to the left. Pull the fuse pull lever forward and to the left until the fuse moves out. Remove and discard the fuse.
3. Seat an identically rated fuse in the holder. Use a 1.5 Amp AC slo-blo fuse for 100/120 AC voltage or a 1.0 Amp AC fast-blo fuse for 200/220 voltage.
4. Slide the fuse window over the fuse. Restore power. Turn the printer back to its operating position.

CAUTION

If the fuse blows again, turn off the printer and contact your Authorized Service Center. Do not remove the cover to locate the cause; there are no user serviceable parts under the cover.

3 ALIGNING LEFT MARGIN CHARACTERS

The printer has a parameter (**X01 FWD/REV COMPENSATION**) for adjusting the vertical alignment of left margin characters. Check and adjust the margin as follows.

1. Ensure that paper is loaded, power is on, and the **READY** indicator off.
2. Press **FORMS**, then **TEST** to enter the parameter set-up mode.
3. Press **TEST** to print the parameter list. If the leftmost characters in the list are aligned vertically, then they are correctly aligned. If not, then the margin is not aligned. Adjust per the following.
4. Press **TEST** then *immediately* press **FORMS**. The printer will print **X01 FWD/REV COMPENSATION**, its current setting, and the parameter change lines.
5. Press **READY** to enter the parameter change mode, then:
   a. Identify the current two-digit compensation control number. The number is on the list and on a sticker at the left side of the printer's platen.
   b. Initially enter a two-digit number one number higher or lower than the current number. Each number represents about one-tenth millimeter (0.004 inch) compensation.
   c. Press **FORMS** to save the change, and **RESET** to exit the parameter list.
6. Press **FORMS**, then **TEST** to re-enter the parameter list.
7. Press **TEST** to print the list. Check the alignment. If correct, press **RESET** to exit the parameter change mode. Write the new number on the sticker. If not correct, repeat steps 4 through 7, and increase or decrease the two-digit number in step 5.b until the margin is correct.

If the printer prints a **WARNING: CHECKSUM ERROR** message at any time, the printer will default to the original factory set number. If this happens, re-enter the correct number per the above.

A PRINTER SPECIFICATIONS

This appendix summarizes the specifications of the printer, including:

- Physical, electrical, and environmental specifications.
- Ribbon, paper, and interface specifications.
- Print characteristics, character set and page format specifications.

Physical

Width 58.42 cm (23 in.)	Height 24.77 cm (9.75 in.)
Depth 33.97 cm (13.375 in.)	Weight 18.16 kg (40 lbs)

Electrical

Site Voltage (User	100/120 VAC, 57-63 Hz
Selectable Voltage)	200/220 VAC, 47-53 Hz
Power	200 Watts Maximum

Temperature Range

Operating	41° F (5° C) to 104° F (40° C)
Storage	-40° F (-40° C) to 160° F (71° C)
Transient	-40° F (-40° C) to 160° F (71° C)

Relative Humidity

Operating	20% to 80%
Storage	10% to 90%
Transient	95% Maximum

Acoustics

Acoustically insulated, structural foam case; noise level approximately 58 dBa

Ribbon, Standard

36 yards of 3/4 inch wide, continuous loop, pre-inked black nylon ribbon packaged in a cartridge.

Types of Paper

Single Sheet	15 to 25 lb single sheet bond paper. Widths ranging from 7.0 to 8.5 inches; lengths between 8.5 and 17.0 inches.
Pinfeed	Continuous single-part fanfold sheets (15 to 20 lb) or up to six-part forms (12 to 15 lb and 6 to 8 lb carbons). The six-part forms include the original plus five copies. (Print quality is specified for the original and first three copies only.) Paper widths can range from 3.5 inches to 14 7/8 inches (including perforations).

Paper Control

Adjustable pinfeed tractors for continuous forms. Semi-automatic single sheet feed.

Interface

Serial	EIA RS 232-C; 10-bit asynchronous frame. Transmission Speeds: 300, 1200, 2400, 4800, 9600 Baud. Cable and Connector: Shielded Cable and Metal DB 25-Pin Male Connector.
IBM	Protocol: XON/XOFF or DTR. Format: 1 start bit, 8 data bits (LSB first), no parity, 1 stop bit.
P-Series	Protocol: Both XON/XOFF and DTR. Format: 1 start bit, low 7 data bits, *(see note, below), 1 stop bit
Note:	This bit may be used for: 8th data bit. Even Parity. Odd Parity. No Parity Check; transmit Mark. No Parity Check; transmit Space.

Interface (Continued)

Parallel	Centronics Compatible. Cable and Connector: Shielded Cable and Metal 36-Pin Male Connector.
Data Length:	8-bit only--IBM. 7 or 8 bit--P-Series

Line Buffering — Automatic, approximately 4K buffer.

Print Head

Ballistic type, staggered 18 wire head, with wires in four columns. 4 wires in columns one and four; 5 wires in columns two and three.

Print Speeds

Draft Print Quality	400 cps, single pass.
Correspondence Quality	300 cps, single pass.
Letter Quality	100 cps, double pass.
Turbo Draft, 12 pitch	480 cps, single pass.

Print Format

Bidirectional	Logic seeking bidirectional printing for maximum throughput.
Draft Matrix Cell	18 dots wide x 9 dots high.
Correspondence Matrix Cell	24 dots wide x 9 dots high.
Letter Matrix Cell	36 dots wide x 18 dots high, dual pass.

Character Sets

IBM Compatible	Full 256 character IBM PC Extended Character Set. Selectable subsets are shown in the Table 1 and Table 2 Character Sets reproduced on the IBM Operational Summary Chart foldout at the back of this Guide.
P-Series Compatible	Resident 96 character USA, English, French, Norwegian, German, Swedish, Spanish ASCII character set.

Graphics

IBM	Dot Graphics: Selectable aspect ratios of 1:1 or 5:6. 1:1 Ratio Graphics Density (dots/inch): 82.5 X 82.5 standard density. 165 X 82.5 dual density (half speed). 165 X 82.5 high density. 330 X 82.5 double density (half speed). 5:6 Ratio Graphics Density (dots/inch): 70 X 82.5 standard density. 140 X 82.5 dual density (half speed). 140 X 82.5 high density. 280 X 82.5 double density (half speed) Block Graphics: 24 X 14 dots/inch, 3-phase, double pass.
P-Series	Dot Graphics: 84 X 84 dots/inch and 168 X 84 dots/inch 1-phase. 168 X 84 dots/inch 2-phase. Block Graphics: 24 X 14 dots/inch, 3-phase, double pass.

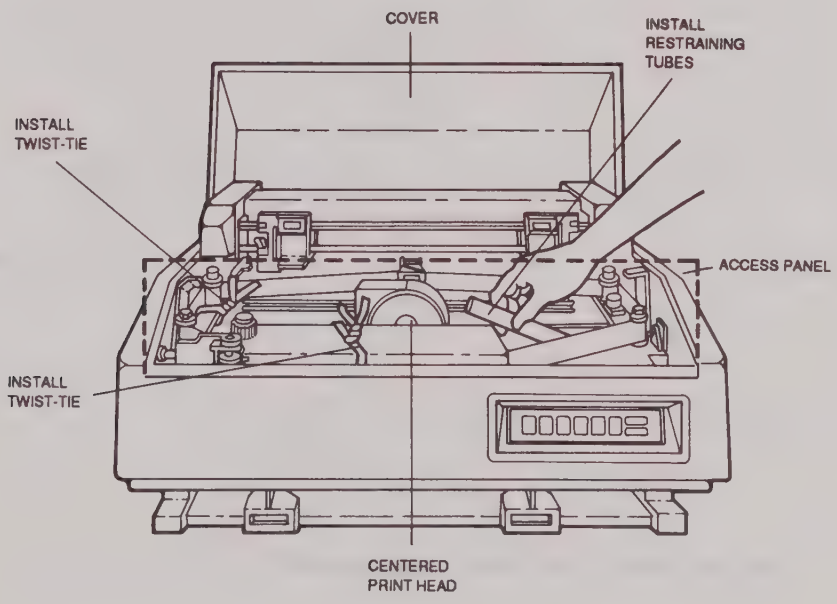
Line Format	
132 Column Line Length	132, 158 or 225 characters across a 13.2 inch print width with fixed spacing at 10, 12 or 17.1 cpi, respectively; more when using proportional spacing.
80 Column Line Length	80, 96 or 132 characters across an 8 inch print width with fixed spacing at 10, 12 or 17.1 cpi, respectively; more when using proportional spacing.
Page Formats	
Forms Length	11 or 12 inch forms; other forms lengths may be set through the printer in 1/144 inch increments.
Margins	Left, right, top and bottom margins may be set through the printer in 1/144 inch vertical and 1/120 inch horizontal increments.
Tabs	Up to 8 vertical tabs in 1/48 or 1/144 inch increments and up to 32 horizontal tabs in 1/120 inch increments may be set via programming.
Printer Diagnostics and self-Test	
Automatic Power-on Diagnostics. Automatic Operational Diagnostics. User Selected--Rolling Character Pattern Self-Test.	

B REPACKING THE PRINTER

In this appendix, we explain how to:

- Reinstall the shipping restraints.
- Repack the printer for storage or shipping.

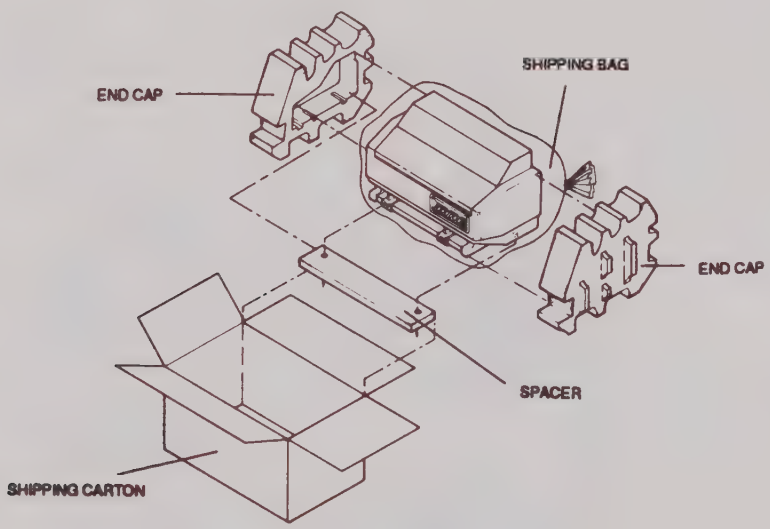
1 INSTALLING THE SHIPPING RESTRAINTS



The printer has several parts that must be secured to avoid damage during storage or shipping. Secure as follows.

1. Unplug the power cord and interface cable from the printer. Store the power cord in the rear paper chute.
2. Open the window and access panel. Set the print density lever to full OPEN.
3. Center the print head; secure with restraining tubes. If tubes are not available, move the head to its rightmost position. Secure the head to the side with a twist-tie.
4. Install the two twist-ties.
5. Close the access panel and window.

2 REPACKING THE PRINTER



Pack the printer for storage or shipping as follows.

NOTE

The printer must be packed properly. Shipping companies will not pay for damage caused by an improperly packed printer.

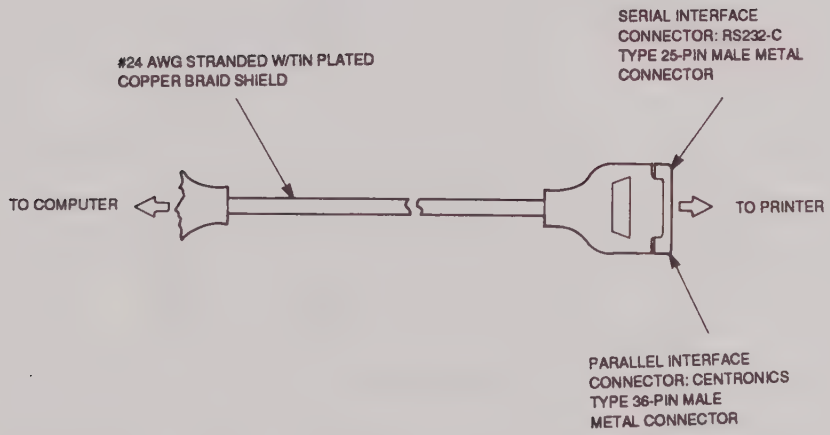
1. Pack the printer with the original shipping materials as shown above. Seal the carton with strong tape.
2. If there are no original shipping materials, pack as follows.
3. Cut a piece of heavy cardbox to fit beneath the base of the printer. Set the piece in a heavy shipping carton.
4. Place the printer in a heavy plastic bag, tape it closed, and place the printer in the carton.
5. Surround the printer with bubble pack to prevent it from shifting. Close the box; seal with strong shipping tape.

C INTERFACE INFORMATION

This appendix discusses:

- Construction of the parallel and serial interface cables and connectors.
- Interface cable pin connections and functions.

1 INTERFACE CABLE CONSTRUCTION



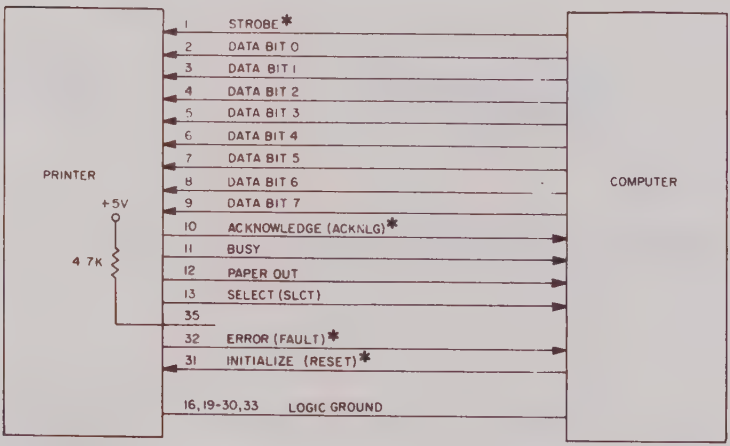
INTERFACE CABLE

The printer can accept both parallel and serial interface cables. The cables are connected to their respective jacks on the back of the printer.

Each cable must be shielded and have a metal connector, as shown above. Use of other cable and connector types may cause radio and television interference.

The parallel cable uses a 36-pin male metal connector. The serial interface cable uses a 25-pin male metal connector. The parallel cables may be up to 3 meters (10 feet) long. The serial cables may be up to 18 meters (60 feet) long.

2 PARALLEL INTERFACE CABLE PIN CONNECTIONS

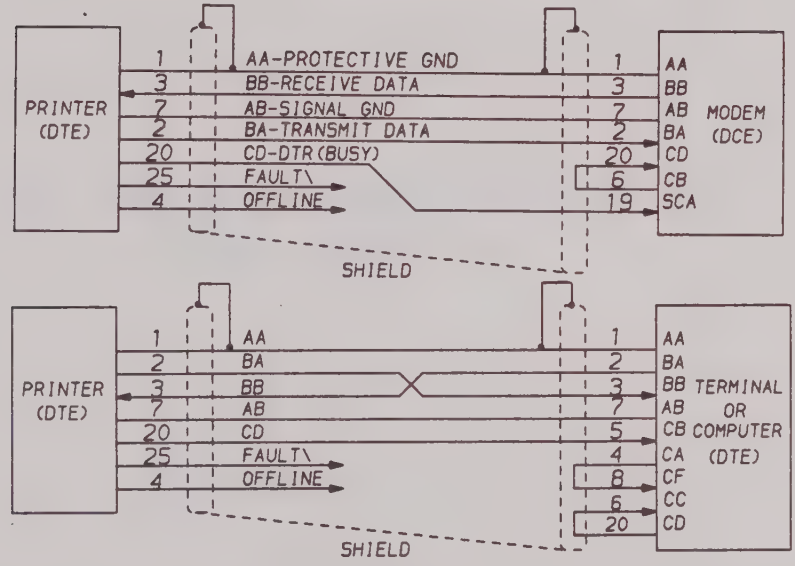


PARALLEL INTERFACE CABLE

LOW ACTIVE SIGNALS ARE INDICATED BY AN ASTERISK (*).

The above illustration shows the pin connections and functions for the parallel interface cable with the 36-pin male connector. You should match the printer pin functions with your computer pin functions before using the cable. Computer pin functions are given in the appropriate computer manual.

3 SERIAL INTERFACE CABLE PIN CONNECTIONS



The above figures show the pin connections for a shielded EIA RS-232-C serial interface cable with a 25-pin male connector. At least three signal wires must be used for proper printer operation. The first two are SIGNAL GROUND (Pin 7) and RECEIVE DATA (Pin 3). To avoid a print buffer overflow, the third wire must transmit BUSY back to the user system. Either TRANSMIT DATA (Pin 2) or DTR (Pin 20) or both can be used to signal the BUSY condition.

The upper figure shows a typical multiplexer/modem configuration. For a full duplex communications link, pins 2, 3, 7, and shield are often sufficient. Where the user system requires a busy level or for half duplex links, the printer's DTR is used. The figure shows it at pin 19, SECONDARY REQUEST TO SEND, because dropping DTR at modem pin 20 disconnects the *call.*

The lower figure shows a Null Modem cable suitable for IBM PC or IBM PC-compatible interfacing. The last two wires loop back RTS to CD and DTR to DSR as part of the modem simulation.

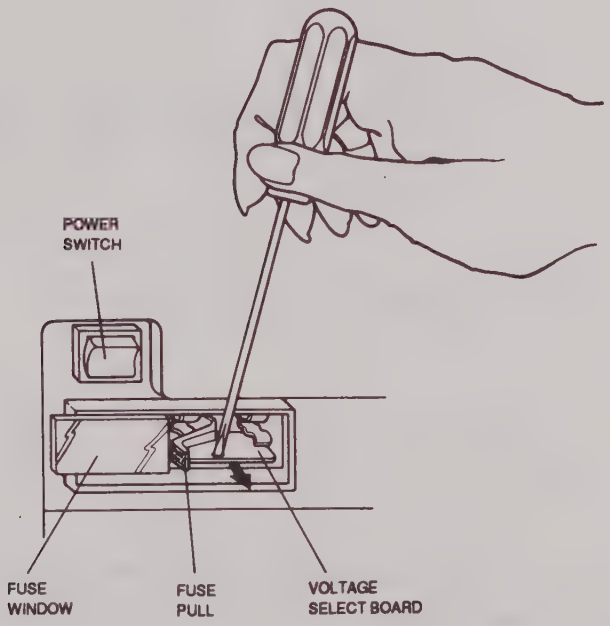
Check your system manuals for other details. Both TRANSMIT DATA and DTR may not be needed. Some installations may require that FAULT, OFFLINE, or PROTECTIVE GROUND remain unconnected.

D SELECTING ALTERNATE AC POWER SOURCES

In this appendix, we show you how to:

- Reset the printer for 100, 120, 200 or 220 VAC power sources.

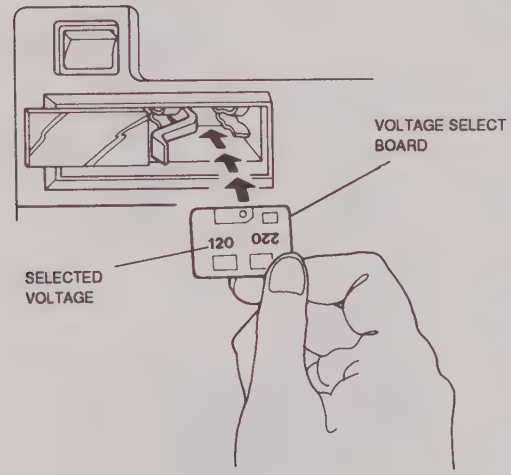
1 REMOVING THE VOLTAGE SELECT BOARD



The printer can be easily and safely set for 100, 120, 200 or 220 VAC through a voltage select board, as follows.

1. Press the power switch Off. Unplug the power cord from the outlet and printer. Turn the printer around.
2. Slide the fuse window to the left to uncover the fuse pull lever and fuse.
3. Pull the fuse pull lever forward and to the left until the fuse moves out. Remove the fuse.
4. Gently pry out the board with a small screwdriver.

2 INSTALLING THE VOLTAGE SELECT BOARD



Select the required voltage and install the voltage select board as follows.

1. Turn the board so that the required voltage number is facing up and readable from the back of the printer.
2. Slide the board into its slot until firmly seated. Check that you can read the selected voltage number.
3. Check that you have the correct fuse for the voltage selected. Use a 1.5 Amp AC slo-blo fuse for 100/120 AC voltage or a 1.0 Amp AC fast-blo fuse for 200/220 voltage.
4. Seat the correct fuse in the fuse holder. Push the fuse pull lever into the printer.
5. Slide the window over the fuse. Turn the printer around.
6. Plug the power cord into the printer and outlet. Press the power switch On.

E PROGRAMMING

In this appendix, we show you how to control printer functions from the computer as follows:

- Programming IBM compatible functions
- Programming P-Series compatible functions
- Graphics Programming
- Programming for Color Printing.

1 PROGRAMMING THE PRINTER

By now you have become familiar with the operation of the printer and used the control panel to set many of its functions. The information in this appendix will help you learn to control printer functions from the computer. You will:

- Set the printer to accept programming commands.
- Learn what programmable printing functions are available in the IBM and P-Series emulations.
- Use control codes and commands to program the printer, allowing you to tailor the output of the printer to meet your printing requirements.

2 SETTING UP FOR PROGRAMMING

You should check the following to be sure that the printer will respond to the programming commands.

- Parallel or serial interface cable securely connected between the printer and computer.
- POWER light on.
- Paper loaded.
- FAULT light out.
- Required Compatible mode selected. See *Selecting the IBM or P-Series Parameter Menu* in Section 6.
- Parameters are set in accordance with the selected Compatible mode and printing requirements.
- READY light on.

3 USING CONTROL CODES

Control codes are messages sent through your computer to the printer telling it how you want your printed copy to look. The control codes allow you to select most of the printer functions available through the control panel plus many additional functions not available through the panel. This extends your control over the printer, and lets you change printer functions in your computer program. Any control function is a line segment terminator and causes any data received prior to it to be printed before execution.

NOTE

When you program the equivalent of parameters #01 through #21, (except #16, #17, and #18 for IBM or #11, #19, and #20 for P-Series) on the parameter list, the parameters affected will automatically change to the programmed value. You may then temporarily use, permanently save, or cancel the changed parameter through the parameter list. You may also cancel the changes by turning the printer off, then on; the printer will default to the last saved parameters.

The printer recognizes the full ASCII character set and its decimal, binary, octal and hexadecimal codes. For purposes of explanation, we will be using the decimal and alphanumeric equivalents of the character set throughout this appendix.

There are two ways for you to program the printer. The first is direct programming of the standard printer functions and control codes. The second is programming for special printer functions. This requires the programming of an ESCape code followed by the alphabetic command code for the selected function.

In either case, you should have some knowledge of BASIC (Beginner's All Purpose Symbolic Instruction Code) programming or knowledge of how to insert control codes into your program or word processing software. The BASIC programming command format is essentially the same for all functions. For example, the typical format for programming underlining in the IBM Compatible mode is:

10 LPRINT CHR$(27);CHR$(45);CHR$(n);

10 = PROGRAM LINE NUMBER (can be any number).

LPRINT CHR$();CHR$();CHR$();=PROGRAM LINE used for programming.

27 = DECIMAL ESCAPE CODE. Only "special" functions require the use of an ESCAPE CODE. "Standard" functions do not use this code.

45 = FUNCTION CODE used for underlining all data following the programming of this function. CHR$(45) is an ASCII - (hyphen).

n = ARGUMENT VALUE. For example, when a 1 (one) is entered in place of n, all data following this code will be underlined. When a 0 (zero) is entered, the underline function is cancelled. Not all functions need an ARGUMENT VALUE.

The P-Series Compatible mode uses the following format for programming the underlining function:

10 LPRINT CHR$(27);"f,n,$";

10 = PROGRAM LINE NUMBER (can be any number).

LPRINT CHR$();" , , ";= PROGRAM LINE used for programming.

27 = DECIMAL ESCAPE CODE. Only "special" functions require the use of an ESCAPE CODE. "Standard" functions do not use this code.

f = FUNCTION CODE used for underlining all data following the programming of this function.

n = ARGUMENT VALUE. For example, when a 1 (one) is entered in place of n, all data following this code will be underlined. When a 0 (zero) is entered, the underline function is cancelled. Not all functions need an ARGUMENT VALUE.

$ = FUNCTION TERMINATOR used to mark the end of a program line. Not all functions require the use of the FUNCTION TERMINATOR.

Each function description also includes the default (reset) value for that particular function. Note that not all functions have a default value.

4 PROGRAMMING IBM COMPATIBLE FUNCTIONS

The IBM Compatible control and function codes are described in this section. Each code description lists the ASCII code, BASIC program line, number of arguments, argument values, and default values. Programming conventions are described in the first part of this appendix.

NOTE

Both IBM and P-Series FUNCTION CODES are arranged under their respective headings in numerical order with non-ESCAPE CODE ("standard") functions appearing first, followed by all functions with ESCAPE CODES ("special").

Before programming in the IBM Compatible mode, set the following parameters:

- Parameter #18 (IBM Graphics/IBM Color) to IBM Graphics for programming in the IBM Graphics Printer mode, or set to IBM Color if programming in the IBM Color Printer mode.
- Parameter #19 (Argument Type) to Binary. If Parameter #19 is set to ASCII, the alternate program line must be used [CHR#(27);"n,$";]. The program lines listed here assume the setting of the parameter to binary.
- Parameter #22 (Compatibility) to one (1).
- Parameter #23 (Interface) to either Parallel or Serial (#23, #24, and #25 all set).
- All other parameters in accordance with the specific printing requirements.

FUNCTION TERMINATOR

This function is used as a terminator at the end of a line. For example, the VERTICAL TAB SET function uses this code at the end of the program line to indicate that all of the needed tabs have been set.

ASCII Code:	NUL
Program Line:	LPRINT CHR$(0);
Arguments:	None
Argument Values:	None
Default Value:	None

BELL

This function sounds the audible alarm within the printer if Parameter #16 (Bell Duration) is not zero (0).

ASCII Code:	BEL
Program Line:	LPRINT CHR$(7);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected.

BACKSPACE

This function backspaces the print head one character width to the left, with the width equal to the monospaced width of the density chosen. The print head will not move until there is data to print. If the left margin is exceeded, the print head positions itself at the left-most margin.

ASCII Code:	BS
Program Line:	LPRINT CHR$(8);
Arguments:	None
Argument Values:	None
Default Value:	None

HORIZONTAL TABBING

This function tabs to the next set horizontal tab position that was set by the HORIZONTAL TAB SET code. Printing with expanded characters may give erratic results if tabs are not set far enough apart.

ASCII Code:	HT
Program Line:	LPRINT CHR$(9);
Arguments:	None
Argument Values:	None
Default Value:	Tab every 8 columns beginning with column 8.

LINE FEED

This function advances the paper one line and performs a carriage return. This function can also be used to cancel the ENLARGED CHARACTERS BY LINE function.

ASCII Code:	LF
Program Line:	LPRINT CHR$(10);
Arguments:	None
Argument Values:	None
Default Value:	None

VERTICAL TABBING

This function advances the paper to the next vertical tab set by the VERTICAL TAB SET function, then performs a carriage return. If no tabs have been set, a single line feed is performed.

ASCII Code:	VT
Program Line:	LPRINT CHR$(11);
Arguments:	None
Argument Values:	None
Default Value:	None

FORM FEED

This function advances paper to the next top-of-form position and performs a carriage return.

ASCII Code:	FF
Program Line:	LPRINT CHR$(12);
Arguments:	None
Argument Values:	None
Default Value:	None

CARRIAGE RETURN

This function causes subsequent data to be printed beginning at the left margin. Line feed occurs if Parameter #09 (Automatic Line Feed on Carriage Return) is on.

ASCII Code:	CR
Program Line:	LPRINT CHR$(13);
Arguments:	None
Argument Values:	None
Default Value:	None

ENLARGED CHARACTERS BY LINE

This function causes all data following in the same line to be printed enlarged (double width). This function is automatically cancelled by word wrapping or the LINE FEED, CARRIAGE RETURN, FORM FEED or VERTICAL TAB functions.

This function may also be cancelled at any time within the line by the CANCEL ENLARGED CHARACTERS function, allowing the mixing of standard width and double width characters within a line. If an enlarged character is programmed at the last print position in a line, the character is printed normal width on the next line.

ASCII Code:	SO or ESC SO
Program Line:	LPRINT CHR$(14); or LPRINT CHR$(27);CHR$(14);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected

SELECT 17.1 CHARACTERS PER INCH

This function overrides the setting of Parameter #02 (Characters Per Inch) and causes all data to be printed at 17.1 characters per inch (cpi). Selecting a different character pitch (10 or 12 cpi) cancels this function.

ASCII Code:	SI or ESC SI
Program Line:	LPRINT CHR$(15); or LPRINT CHR$(27);CHR$(15);
Arguments:	None
Argument Values:	None
Default Value:	10 cpi

SELECT PRINTER

This function allows the printer to receive and print data sent from the computer if the READY indicator (on the control panel) is lit.

ASCII Code:	DC1
Program Line:	LPRINT CHR$(17);
Arguments:	None
Argument Values:	None
Default Value:	Selected

SELECT 10 CHARACTERS PER INCH

This function overrides the setting of Parameter #02 (Characters Per Inch) and causes all data to be printed at 10 characters per inch (cpi). Selecting a different character pitch (12 or 17.1 cpi) cancels this function

ASCII Code:	DC2
Program Line:	LPRINT CHR$(18);
Arguments:	None
Argument Values:	None
Default Value:	10 CPI

DESELECT PRINTER

This function causes the printer to ignore all incoming data sent by the computer. The interface continues to accept all data, looking for the SELECT PRINTER function, or manual selection by the operator. The READY indicator on the control panel blinks off and on as a warning that data will not be printed.

ASCII Code:	DC3
Program Line:	LPRINT CHR$(19);
Arguments:	None
Argument Values:	None
Default Value:	Select Printer

CANCEL ENLARGED CHARACTERS

This function cancels the ENLARGED CHARACTERS BY LINE function.

ASCII Code:	DC4
Program Line:	LPRINT CHR$(20);
Arguments:	None
Argument Values:	None
Default Value:	None

CLEAR DATA

This function resets the printer to the non-volatile RAM parameters if the "soft" mode was selected by Parameter #21 (Reset Mode) or the SET INITIALIZATION function. If the "hard" mode was selected, this function clears the data back to the previous function code without printing it while retaining all function settings except for the ENLARGED CHARACTERS BY LINE function.

ASCII Code:	CAN
Program Line:	LPRINT CHR$(24);
Arguments:	None
Argument Values:	None
Default Value:	None

SAVE CURRENT PARAMETERS

This function updates the NVRAM load of all 21 "temporary" parameters, including the three that cannot be altered by other functions. The Parameters #22 and above are also rewritten (unchanged) with a new checksum. These parameters become the new defaults for the next RESET function, power-up reset, or not-ready mode reset (test-reset).

ASCII:	SUB
Program Line:	LPRINT CHR$(26)
Arguments:	None
Argument Values:	None
Default Values:	None

UNDERLINE ON/OFF

This function turns the underline feature function on or off depending on the value of (n). When n=1 (one), all print data that follows is underlined. When n=0 (zero), the underline feature is turned off.

ASCII Code:	ESC -
Program Line:	LPRINT CHR$(27);CHR$(45);CHR$(n)
Arguments:	1 (n)
Argument Values:	n=0 (Off) or 1 (On)
Default Value:	Underline Off

1/8 INCH LINE FEED INCREMENT

This function sets the line feed increment to 1/8 inch (eight lines per inch) and overrides Parameter #08 (Vertical Advance-1).

ASCII Code:	ESC 0
Program Line:	LPRINT CHR$(27);CHR$(48);
Arguments:	None
Argument Values:	None
Default Value:	1/8 Inch Line Feed Not Selected

GRAPHIC LINE FEED

This function overrides Parameter #08 (Vertical Advance-1) and sets line spacing to 7/84 inch. It is primarily used for seven bit graphics programming. See *Graphics Programming* later in this appendix for more information about this function.

ASCII Code:	ESC 1
Program Line:	LPRINT CHR$(27);CHR$(49);
Arguments:	None
Argument Values:	None
Default Value:	Graphic Line Feed Not Selected

SET LINE FEED TO STORED LINE FEED VALUE

This function overrides Parameter #08 (Vertical Advance-1) and initializes the line feed code to the value previously set by the STORE LINE FEED VALUE function. Six lines per inch is assumed if no STORE LINE FEED VALUE function is executed.

ASCII Code:	ESC 2
Program Line:	LPRINT CHR$(27);CHR$(50);
Arguments:	None
Argument Values:	None
Default Value:	Stored Line Feed Value=1/6 Inch

SET VERTICAL SPACING TO N/144 INCH

This function overrides the setting of Parameter #08 (Vertical Advance-1) and sets line spacing in 1/144 inch increments. The valid arguments are between 1/144 and 255/144 inches. Line spacing of 14/144 inch is recommended for 8-bit graphics programming.

ASCII Code:	ESC 3
Program Line:	LPRINT CHR$(27);CHR$(51);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=1 to 255 (1/144 Inch Increments)*
Default Value:	None

* If Parameter #18 is set to IBM Graphics, then the arguments range between 1/216 and 255/216 increments, although the parameter list states 1/144 inch increments.

SET TOP-OF-FORM

This function overrides the setting of Parameter #07 (Top Margin) and sets the top-of-form to the present vertical position of the paper.

ASCII Code:	ESC 4
Program Line:	LPRINT CHR$(27);CHR$(52);
Arguments:	None
Argument Values:	None
Default Value:	Current Paper Position

AUTOMATIC LINE FEED ON/OFF

This function overrides the setting of Parameter #09 (Automatic Line Feed on Carriage Return) and selects automatic line feed when a carriage return is detected.

ASCII Code:	ESC 5
Program Line:	LPRINT CHR$(27);CHR$(53);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (Off) or 1 (On)
Default Value:	None

SELECT TABLE 2

This function overrides the setting of Parameter #20 (Table 1/Table 2) and selects Table 2 character and block graphics set. Block graphics programming is explained later in this appendix.

ASCII Code:	ESC 6
Program Line:	LPRINT CHR$(27);CHR$(54);
Arguments:	None
Argument Values:	None
Default Value:	Table 2 Selected

SELECT TABLE 1

This function overrides the setting of Parameter #20 (Table 1/Table 2) and selects Table 1 character and block graphics set. Block graphics programming is explained later in this appendix.

ASCII Code:	ESC 7
Program Line:	LPRINT CHR$(27);CHR$(55);
Arguments:	None
Argument Values:	None
Default Value:	Table 2 Selected

SELECT 12 CHARACTERS PER INCH

This function overrides the setting of Parameter #02 (Characters Per Inch) and causes all data to be printed at 12 characters per inch (cpi). When using draft mode with proportional spacing, the print density is 13.3 cpi fixed spacing instead of 12 cpi. However, turbo draft does not print 13.3 cpi.

ASCII Code:	ESC :
Program Line:	LPRINT CHR$(27);CHR$(58);
Arguments:	None
Argument Values:	None
Default Value:	10 CPI

HOME PRINT HEAD

This function returns the print head to the home position without changing the next print position. Note that the carriage return function places the next printable character at the left margin without always causing right to left print head motion.

ASCII Code:	ESC <
Program Line:	LPRINT CHR$(27);CHR$(60);
Arguments:	None
Argument Values:	None
Default Value:	None

SET INITIALIZATION

This function overrides the setting of Parameter #21 (Reset Mode) and selects the "soft" (0) or "hard" (1) mode for initialization. When in the "soft" mode, the initialization function places a data clearing signal into the buffer. It clears data between it and the last received code or pseudo-code, such as block graphics, not resetting the download buffer but resetting all functions to power-on defaults. When in the "hard" mode, the initialization function clears the print buffer back to the last code or pseudo-code and clears download font buffers.

ASCII Code:	ESC ?
Program Line:	LPRINT CHR$(27);CHR$(63);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (Soft) or 1 (Hard)
Default Value:	Initialization Soft

SELECT ASCII/BINARY ARGUMENT VALUES

This function overrides the setting of Parameter #19 (Argument Type) and selects ASCII codes when the argument is one (1) and binary codes when the argument is zero (0).

This function is primarily used when the computer specifically requires this mode for operation, or when writing a software package. Normal printer operation does not require selection of this function.

ASCII Code:	ESC @
Program Line: (Binary to ASCII)	LPRINT CHR$(27);CHR$(64);CHR$(1);
Program Line: (ASCII to Binary)	LPRINT CHR$(27);"@,0,$";
Arguments:	1 (n)
Argument Values:	n=0 (Binary) or 1 (ASCII)
Default Value:	Binary

STORE LINE FEED VALUE

This function stores a value (in 1/72 inch increments) that becomes the value of the LINE FEED function after the SET LINE FEED TO STORED LINE FEED VALUE function is performed.

ASCII Code:	ESC A
Program Line:	LPRINT CHR$(27);CHR$(65);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=1/72 to 85/72 Inch Increments
Default Value:	12/72 Inch

VERTICAL TAB SET

This function sets up to 64 vertical tabs. The vertical tabs are identified by the line number with the top-most line being zero (0). Tab settings must be set in ascending order. A new vertical tab function clears the previous tabs and enters the new value. The vertical tab positions do not take effect until a FUNCTION TERMINATOR code is received.

The line feed value presently in effect determines the physical position on the page when this function is used. The page length should be set before the vertical tabs are set. The VERTICAL TABBING function initiates tabs set by this function.

ASCII Code:	ESC B NUL
Program Line:	LPRINT CHR$(27);CHR$(66); CHR$(n1);....CHR$(n64);CHR$(0);
Arguments:	64 (n1 through n64)
Argument Values:	n=1 to 255 Vertical Increments
Default Value:	Vertical Tab=Current Line Feed Value

PAGE LENGTH SET IN LINES

This function dictates the length of the form in lines and overrides Parameter #05 (Form Length) and Parameter #06 (Available Space). The form length is set by the number of lines, then converted to inches based on the current line feed value. When this function is issued, the top-of-form position is set to the present vertical position on the paper.

ASCII Code:	ESC C
Program Line:	LPRINT CHR$(27);CHR$(67);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=1 to 127 lines
Default Value:	None

PAGE LENGTH SET IN INCHES

This function overrides the setting of Parameter #05 (Form Length) and Parameter #06 (Available Space) and dictates the length of the form in inches, with a range of 1 to 22. If line spacing is altered later, the form length in inches remains unaffected. When this function is issued, the top-of-form position is set to the present vertical position on the paper.

ASCII	ESC C NUL
Program Line:	LPRINT CHR$(27);CHR$(67); CHR$(0);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=1 to 22 inches
Default Value:	None

HORIZONTAL TAB SET

This function sets up to 28 horizontal tab positions. The value of the horizontal tab position is dictated by the column position, with 0 being the first column position and 222 being the largest acceptable tab position. This is based on the monospaced print density selected (either 10, 12, or 17.1 cpi) when a HORIZONTAL TAB SET function is issued. If the ENLARGED CHARACTERS BY LINE function is used with this function, the tab positions refer to the column position of the non-enlarged monospaced print density. This function must end with a FUNCTION TERMINATOR.

Tab positions that go beyond the right margin at the current selected density cause data to wrap to the next line. Even more tabbing within the wrapped print line causes erratic results. Tab values with enlarged print must be at least three columns apart and tabs with non-enlarged print must be at least two columns apart. The HORIZONTAL TABBING function initiates tabs set by this function.

ASCII Code:	ESC D NUL
Program Line:	LPRINT CHR$(27);CHR$(68); CHR$(n1);....CHR$(n28);CHR$(0);
Arguments:	1-28 (n1 to n28)
Argument Values:	n=0 to 255 Columns
Default Value:	Tab Every 8 Columns Beginning with Column 8

EMPHASIZED CHARACTERS

This function overrides the setting of Parameter #14 (Emphasized) and selects the two-pass print mode. All characters are printed once, the carriage is returned, and the characters are reprinted with a slight horizontal offset.

ASCII Code:	ESC E
Program Line:	LPRINT CHR$(27);CHR$(69);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected

CANCEL EMPHASIZED CHARACTERS

This function overrides the setting of Parameter #14 (Emphasized) and cancels the EMPHASIZED CHARACTERS function.

ASCII Code:	ESC F
Program Line:	LPRINT CHR$(27);CHR$(70);
Arguments:	None
Argument Values:	None
Default Value:	None

DOUBLE STRIKE PRINT

This function overrides the setting of Parameter #13 (Double Strike) and selects the two-pass print mode. The characters are printed once, the carriage is returned, and the characters are reprinted with no horizontal offset.

ASCII Code:	ESC G
Program Line:	LPRINT CHR$(27);CHR$(71);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected

CANCEL DOUBLE STRIKE PRINT

This function overrides the setting of Parameter #13 (Double Strike) and cancels the DOUBLE STRIKE PRINT function.

ASCII Code:	ESC H
Program Line:	LPRINT CHR$(27);CHR$(72);
Arguments:	None
Argument Values:	None
Default Value:	None

NEW FONT SELECT

This function overrides the setting of Parameter #01 (Character Set) and selects one of four different character sets: Draft Quality (1), Text Quality (2), Letter Quality (3), or Turbo Draft (102).

ASCII Code:	ESC I
Program Line:	LPRINT CHR$(27);CHR$(73);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=1 to 255 with 1 (Draft Quality), 2 (Text Quality), 3 (Letter Quality), or 102 (Turbo Draft)
Default Value:	1 (U.S. Draft Quality)

EXECUTE VERTICAL SPACING OF N/144 INCH

This function executes a line feed in 1/144 inch increments as set by the argument (n), then performs a carriage return. This function will not change the present line feed settings, and the value of the argument is not saved. This function also allows printing in the auto-skip area at the bottom of the form.

ASCII Code:	ESC J
Program Line:	LPRINT CHR$(27);CHR$(74);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=1 to 255 (1/144 Inch Increments)
Default Value:	None

SELECT STANDARD DENSITY GRAPHICS

This function sets dot spacing to 82.5 by 82.5 dpi in a 1:1 aspect ratio or 70 by 82.5 in a 5:6 aspect ratio. This function is explained later under *Graphics Programming*.

ASCII Code:	ESC K
Program Line:	LPRINT CHR$(27);CHR$(75);CHR$(n1); CHR$(n2);non-ASCII Graphics Data
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 255; n2=0 to 255;Graphics Length=(256*n2)+n1
Default Value:	Not Selected

SELECT DUAL DENSITY GRAPHICS

This function sets dot spacing to 165 by 82.5 dpi in a 1:1 aspect ratio or 140 by 82.5 in a 5:6 aspect ratio. This function is explained later under *Graphics Programming*.

ASCII Code:	ESC L
Program Line:	LPRINT CHR$(27);CHR$(76);CHR$(n1); CHR$(n2);non-ASCII Graphics Data;
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 255; n2=0 to 255; Graphics Length=(256*n2)+n1
Default Value:	Not Selected

JUSTIFICATION ON/OFF

This code overrides the setting of Parameter #15 (Justify) and automatically adjusts the length of the printed line to square off the left and right margins. If necessary, long lines of text are broken at word boundaries to form new lines as required (word wrapping).

Correct justification by the printer can be assured if no function codes are inserted in the data stream to be justified. To prevent justification of the last line of a paragraph, or any line of data, use the BS code followed by the CR code.

The line segment data is analyzed by the printer to determine whether or not the line segment should be justified. The data is justified if either the line segment length exceeds 75% of the distance from the last line segment to the right margin, or the line segment length exceeds 0.325 inch and less than 1.25 inches of white space remains.

ASCII Code:	ESC M
Program Line:	LPRINT CHR$(27);CHR$(77);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (Off) and 1 (On)
Default Value:	Justification Off

PERFORATION SKIP

This function sets the number of lines to be skipped at the bottom of a page. This is based on the present line feed setting that is converted to inches. The current form length minus this skip value overrides Parameter #06 (Avail Space/Form). If the value of the argument is greater than the current form length only one line will be printed on each form. Note that the EXECUTE VERTICAL SPACING OF N/144 function does not cause a perforation skip. When the form length is changed, the perforation skip is set to zero.

To set perforation skip, use the following code:

ASCII Code:	ESC N
Program Line:	LPRINT CHR$(27);CHR$(78);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=1 to 127 Lines
Default Value:	None

To cancel the SET PERFORATION SKIP function, use either set form length, or the following code:

ASCII Code:	ESC O
Program Line:	LPRINT CHR$(27);CHR$(79);
Arguments:	None
Argument Values:	None
Default Value:	Selected

PROPORTIONAL SPACING ON/OFF

This function overrides the setting of Parameter #12 (Proportional Spacing) and causes all data to be proportionally spaced when an argument value of one (1) is selected. An argument value of zero (0) cancels this function.

ASCII Code:	ESC P
Program Line:	LPRINT CHR$(27);CHR$(80);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (Off) or 1 (On)
Default Value:	Proportional Spacing Off

DESELECT PRINTER BY TYPE

This function allows certain applications software packages to identify the printer as an IBM PC Color Printer (Model 5182) emulation. If the third byte is an ASCII STX character (2), the printer does the DESELECT PRINTER function (cf. DC3). Any other third byte causes all three bytes to be ignored.

ASCII Code:	ESC Q STX
Program Line:	LPRINT CHR$(27);CHR$(81);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=2
Default Value:	Select Printer

RESET ALL TABS

This function sets all vertical and horizontal tabs to default values.

ASCII Code:	ESC R
Program Line:	LPRINT CHR$(27);CHR$(82);
Arguments:	None
Argument Values:	None
Default Value:	Horizontal Tabs=Every 8th Column; Vertical Tabs=Current Line Feed Value

SUPERSCRIPT/SUBSCRIPT ON/OFF

When the argument value is zero (0), this function causes all characters to be printed one-half height in the upper half of the character cell (Superscript). When the argument value is one (1), it causes all characters to be printed one-half height in the lower half of the character cell (Subscript).

ASCII Code:	ESC S
Program Line:	LPRINT CHR$(27);CHR$(83);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (Superscript On) or 1 (Subscript On)
Default Value:	Superscript and Subscript Off

To turn off Superscript/Subscript:

ASCII Code:	ESC T
Program Line:	LPRINT CHR$(27);CHR$(84);
Arguments:	None
Argument Values:	None
Default Value:	Superscript/Subscript Off

UNIDIRECTIONAL PRINT ON/OFF

This function prints all data unidirectionally if the argument is one (1). Data is printed bidirectionally if the argument is zero (0) except when the print mode calls for unidirectional printing.

ASCII Code:	ESC U
Program Line:	LPRINT CHR$(27);CHR$(85);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (Bidirectional Printing) or 1 (Unidirectional Printing)
Default Value:	Bidirectional Printing.

ENLARGED CHARACTERS ON/OFF

This function overrides the setting of Parameter #11 (Double Width) and selects (1) or cancels (0) the enlarged (double width) character mode.

ASCII Code:	ESC W
Program Line:	LPRINT CHR$(27);CHR$(87);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (Off) or 1 (On)
Default Value:	Enlarged Characters Off

SET LEFT AND RIGHT MARGINS

This function overrides the settings of Parameter #03 (Left Margin) and Parameter #04 (Right Margin), and sets the left and right margins (in columns) in reference to the left-most printable position. The columns are changed to inches based on the current pitch (10, 12, or 17.1) selection. Both arguments must be used for this function to operate properly.

The left and right margins cannot be set closer to each other than 1/2 inch or this function is ignored. If the right margin goes beyond the maximum allowable column width, the margin is set to the maximum allowable value.

ASCII Code:	ESC X
Program Line:	LPRINT CHR$(27);CHR$(88);CHR$(n1);CHR$(n2);
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 213 Columns; n2=5 to 222 Columns
Default Value:	Left Margin=Column 0; Right Margin=Column 132 at 10 cpi

SELECT HIGH DENSITY GRAPHICS

This function sets dot spacing to 165 by 82.5 dpi in a 1:1 aspect ratio or 140 by 82.5 dpi in a 5:6 aspect ratio. This function is explained in greater detail under *Graphics Programming*.

ASCII Code:	ESC Y
Program Line:	LPRINT CHR$(27);CHR$(89);CHR$(n1); CHR$(n2);(non-ASCII Graphics Data);
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 255; n2=0 to 255; Graphics Length=(256*n2)+n1
Default Value:	Not Selected

SELECT DOUBLE DENSITY GRAPHICS

This function sets dot spacing to 330 by 82.5 dpi in a 1:1 aspect ratio or 280 by 82.5 dpi in a 5:6 aspect ratio. This function is explained in greater detail under *Graphics Programming*.

ASCII Code:	ESC Z
Program Line:	LPRINT CHR$(27);CHR$(90);CHR$(n1); CHR$(n2);(non-ASCII Graphics Data);
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 255; n2=0 to 255;Graphics Length=(256*n2)+n1
Default Value:	Not Selected

PRINT CONTROL CODES

This function disables function decoding for up to 65,535 bytes. The 16-bit count argument is decremented as the printer prints each character in the decimal 0 to 255 area of the ASCII code chart. A space is printed for each character not defined in the current character font. Nulls are non-spacing.

While printing in this mode, reaching the right margin causes a line feed function with the following character printed at the left margin. No other functions can be performed when this function is being used.

ASCII Code:	ESC \
Program Line:	LPRINT CHR$(27);CHR$(92); CHR$(n1);CHR$(n2);
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 255; n2=0 to 255; Print All Length=(256*n2)+n1
Default Value:	None

REVERSE LINE FEED

This function initiates a reverse line feed based on the current line feed increment setting. The print head cannot be moved and the paper cannot be reverse line fed past the top-of-form setting with this function.

ASCII Code:	ESC]
Program Line:	LPRINT CHR$(27);CHR$(93);
Arguments:	None
Argument Values:	None
Default Value:	None

PRINT CHARACTER BELOW DECIMAL 32

This function prints a single character less than decimal 32.

ASCII Code:	ESC ^
Program Line:	LPRINT CHR$(27);CHR$(94);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=characters between decimal 0 and 32
Default Value:	None

AUTOMATIC RIBBON BAND SHIFT

This function overrides the setting of Parameter #10 (Ribbon Auto Shift) and allows the ribbon to shift one band at the end of each page. This function is primarily used with the black ribbon to prolong ribbon life.

ASCII Code:	ESC a
Program Line:	LPRINT CHR$(27);CHR$(97);
Arguments:	None
Argument Values:	None
Default Value:	Selected

SELECT RIBBON BAND 4

This function selects the fourth ribbon band (black for all three ribbon types) and prints with this band until another command to change the ribbon band is received. See *Programming for Color Printing*.

ASCII Code:	ESC b
Program Line:	LPRINT CHR$(27);CHR$(98);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected

SELECT RIBBON BAND 3

This function selects the third ribbon band (cyan for the process ribbon and blue for the primary ribbon). The printer prints with this band until another command to change the ribbon band is received. See *Programming for Color Printing*.

ASCII Code:	ESC c
Program Line:	LPRINT CHR$(27);CHR$(99);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected

RELATIVE FORWARD POSITIONING

This function positions the next print character in relation to the closest 1/120 inch mark to the right of the last dot of the present character. Note that each character must be programmed separately. This function only prints from left to right, although the right margin may be exceeded. If this occurs, the print head is returned to the left-most printable position.

The arguments (n1 and n2) are in 1/120 inch increments ranging between 1/120 inch and 1584/120 inches. To enter a value larger than 255/120 inches, n2 must be set in increments of 1 for every 256/120 inch increments entered. The remainder is entered into n1. For example, to program 500/120 inches, do the following:

1. Divide 500 by 256 to determine n2. For this example n2 is 1.
2. The remainder of 500/120 inches after performing step 1 is 244. This is the value for n1.

ASCII Code:	ESC d
Program Line:	LPRINT CHR$(27);CHR$(100); CHR$(n1);CHR$(n2);
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 255 in 120th inch increments; n2=0 to 6 in 256/120th inch increments
Default Value:	None

RELATIVE REVERSE POSITIONING

This function positions the next print character in relation to the closest 1/120 inch mark to the right of the last dot of the present character. Note that each character must be programmed separately. This function only prints from left to right. If the left-most printable position is exceeded, the character is positioned at the left-most printable position.

The arguments (n1 and n2) are in 1/120 inch increments ranging between 1/120 inch and 1584/120 inches. To enter a value larger than 255/120 inches, n2 must be set in increments of 1 for every 256/120 inch increments entered. The remainder is entered into n1.

For example, to program 600/120 inches, do the following:

1. Divide 600 by 256 to determine n2. In this example n2 is 2.
2. The remainder of 600/120 inches after performing step 1 is 88. This is the value for n1.

ASCII Code:	ESC e
Program Line:	LPRINT CHR$(27);CHR$(101); CHR$(n1);CHR$(n2);
Arguments:	2 (n1 and n2)
Argument Values:	n1=0 to 255 in 120th inch increments; n2=0 to 6 in 256/120th inch increments
Default Value:	None

SELECT RIBBON BAND 2

This function selects the second ribbon band (magenta for process ribbons and green for primary ribbons). The printer prints with this band until another command to change the ribbon band is received. See *Programming for Color Printing.*

ASCII Code:	ESC m
Program Line:	LPRINT CHR$(27);CHR$(109);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected.

SELECTING ASPECT RATIO

The aspect ratio can be set for either a 1:1 or 5:6 ratio. The 1:1 aspect ratio is used for bit image graphics to better the quality and make easier bit-position calculations. The 5:6 aspect ratio is used when graphics are printed to duplicate the shape appearing on the display. The 5:6 ratio is the power-on default. More information on aspect ratio is given in *Graphics Programming.*

ASCII Code:	ESC n
Program Line:	LPRINT CHR$(27);CHR$(110);CHR$(n);
Arguments:	1 (n)
Argument Values:	n=0 (5:6 ratio) or 1 (1:1 ratio)
Default Value:	5:6 Aspect Ratio

SELECT RIBBON BAND 1

This function selects the first ribbon band (yellow for process ribbons and red for primary ribbons). The printer prints with this band until another command to change the ribbon band is received. See *Programming for Color Printing.*

ASCII Code:	ESC y
Program Line:	LPRINT CHR$(27);CHR$(121);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected

5 PROGRAMMING P-SERIES COMPATIBLE FUNCTIONS

The P-Series Compatible control and function codes are described in this section. Each code description lists the ASCII code, BASIC program line, number of arguments, argument values, and default value. Programming conventions are described in the first part of this appendix.

Before programming in the P-Series Compatible mode, set the following parameters:

- Parameter #22 (Extended Control Code) to On.
- Parameter #23 (Compatibility) to 0.
- Parameter #24 (Interface) to either Parallel or Serial (#24 to #28 all set).
- All other parameters in accordance with the specific printing requirements.

EXPANDED PRINT MODE

Expanded print mode overrides the setting of Parameter #13 (Double Width) and prints all characters following it at double width.

ASCII:	SOH
Program Line:	LPRINT CHR$(1);
Arguments:	None
Argument Values:	None
Default Value:	Normal Print Mode

NORMAL PRINT MODE

Normal print mode overrides the setting of Parameter #13 (Double Width) and prints all characters following it at normal (single) width.

ASCII:	STX
Program Line:	LPRINT CHR$(2);
Arguments:	None
Argument Values:	None
Default Value:	Selected

DOT GRAPHICS MODE

This code causes the printer to enter the dot graphics mode.

ASCII:	ETX
Program Line:	LPRINT CHR$(3);non-ASCII graphics data;
Arguments:	None
Argument Values:	None
Default Value:	Non-Graphics Mode

JUSTIFICATION

This code overrides the setting of Parameter #17 (Justify) and automatically adjusts the length of the printed line to square off the left and right margins. If necessary, long lines of text are broken at word boundaries to form new lines as required (word wrapping).

Correct justification by the printer can be assured if no function codes are inserted in the data stream to be justified. To prevent justification of the last line of a paragraph, or any line of data, use the BS code followed by the CR code.

The line segment data is analyzed by the printer to determine whether or not the line segment should be justified. The data is justified if either the line segment length exceeds 75% of the distance from the last line segment to the right margin, or the line segment length exceeds 0.325 inch and less than 1.25 inches of white space remains.

To turn on justification, use the following code.

ASCII:	EOT
Program Line:	LPRINT CHR$(4);
Arguments:	None
Argument Values:	None
Default Value:	Justification Off

To turn off justification, use the following code:

ASCII:	ENQ
Program Line:	LPRINT CHR$(5);
Arguments:	None
Argument Values:	None
Default Value:	Justification Off

FIXED SPACING

This function overrides the setting of Parameter #14 (Proportional Spacing) and allows fixed spacing between characters.

ASCII:	ACK
Program Line:	LPRINT CHR$(6);
Arguments:	None
Argument Values:	None
Default Value:	Selected

BELL

This function sounds the audible alarm within the printer if Parameter #19 (Bell Duration) is not zero (0).

ASCII:	BEL
Program Line:	LPRINT CHR$(7);
Arguments:	None
Argument Values:	None
Default Value:	Not Selected

BACKSPACE

This function causes the print head to backspace one character width (based on the character density selected). Note that the left margin cannot be exceeded when backspacing.

ASCII:	BS
Program Line:	LPRINT CHR$(8);
Arguments:	None
Argument Values:	None
Default Value:	None

HORIZONTAL TABBING

This code moves the print head to the next horizontal tab position that was set by the HORIZONTAL TAB SET code. If no tabs have been set, this code is ignored.

ASCII:	HT
Program Line:	LPRINT CHR$(9);
Arguments:	None
Argument Values:	None
Default Value:	None

VERTICAL ADVANCE-1 WITH CARRIAGE RETURN (LINE FEED)

This function causes paper to be moved the vertical distance specified by the SET VERTICAL ADVANCE-1 function or Parameter #08 (Vertical Advance-1) and performs a carriage return. Note that this function is performed regardless of the setting of Parameter #22 (Extended Control Code Set).

ASCII:	LF
Program Line:	LPRINT CHR$(10);
Arguments:	None
Argument Values:	None
Default Value:	None

VERTICAL TABBING

This function advances the paper to the next vertical tab set by the VERTICAL TAB SET function. If no tabs have been set, this code is ignored.

ASCII:	VT
Program Line:	LPRINT CHR$(11);
Arguments:	None
Argument Values:	None
Default Value:	None

FORM FEED

This function causes paper to be advanced to the next top-of-form position. Note that this function is performed regardless of the setting of Parameter #22 (Extended Control Code Set).

ASCII:	FF
Program Line:	LPRINT CHR$(12);
Arguments:	None
Argument Values:	None
Default Value:	None

CARRIAGE RETURN

This function performs a carriage return to the beginning of the same line. Note that this function is performed regardless of the setting of Parameter #22 (Extended Control Code Set). If parameter #11 (Auto Line Feed on Carriage Return) is on, the Vertical Advance-1 function is also performed.

ASCII:	CR
Program Line:	LPRINT CHR$(13);
Arguments:	None
Argument Values:	None
Default Value:	None

VERTICAL ADVANCE-2 WITH CARRIAGE RETURN

This function moves paper the vertical distance specified by the SET VERTICAL ADVANCE-2 function or Parameter #09 (Vertical Advance-2) and performs a carriage return.

ASCII:	SO
Program Line:	LPRINT CHR$(14);
Arguments:	None
Argument Values:	None
Default Value:	None

PROPORTIONAL SPACING

This function overrides the setting of Parameter #14 (Proportional Spacing) and causes all characters following it to be printed with intercharacter proportional spacing. Selecting the FIXED SPACING function cancels this function. This function will not operate when using draft quality print.

ASCII:	DLE
Program Line:	LPRINT CHR$(16);
Arguments:	None
Argument Values:	None
Default Value:	Fixed Spacing

SELECT PRINTER

This function allows the printer to receive and print data sent from the computer if the READY indicator (on the control panel) is lit.

ASCII:	DC1
Program Line:	LPRINT CHR$(17);
Arguments:	None
Argument Values:	None
Default Value:	Selected

VERTICAL ADVANCE-1 WITHOUT CARRIAGE RETURN

This function causes paper to be moved the vertical distance specified by the SET VERTICAL ADVANCE-1 function or Parameter #08 (Vertical Advance-1) without performing a carriage return.

ASCII:	DC2
Program Line:	LPRINT CHR$(18);
Arguments:	None
Argument Values:	None
Default Value:	None

DESELECT PRINTER

This function causes the printer to ignore all incoming data sent by the computer. The interface continues to accept all data, looking for the SELECT PRINTER function. The READY indicator on the control panel blinks off and on as a warning that data will not be printed.

ASCII:	DC3
Program Line:	LPRINT CHR$(19);
Arguments:	None
Argument Values:	None
Default Value:	Select Printer

VERTICAL ADVANCE-2 WITHOUT CARRIAGE RETURN

This function causes paper to be moved the vertical distance specified by the SET VERTICAL ADVANCE-2 function or Parameter #09 (Vertical Advance-2) without performing a carriage return.

ASCII:	DC4
Program Line:	LPRINT CHR$(20);
Arguments:	None
Argument Values:	None
Default Value:	None

RESET PRINTER

This function resets the printer to the non-volatile RAM parameters if the "soft" mode was selected as specified by Parameter #21 (Reset Mode) or the SELECT RESET MODE function. If the "hard" mode was selected, this function clears the data back to the previous function code without printing it while retaining all function settings.

ASCII:	CAN
Program Line:	LPRINT CHR$(24);
Arguments:	None
Argument Values:	None
Default Value:	None

VERTICAL ADVANCE-3 WITHOUT CARRIAGE RETURN

This function causes paper to be moved the vertical distance specified by the SET VERTICAL ADVANCE-3 function or Parameter #10 (Vertical Advance-3) without performing a carriage return.

ASCII:	EM
Program Line:	LPRINT CHR$(25);
Arguments:	None
Argument Values:	None
Default Value:	None

SAVE CURRENT PARAMETERS

This function updates the NVRAM load of all 21 "temporary" parameters, including the three that cannot be altered by other functions. The Parameters #22 and above are also rewritten (unchanged) with a new checksum. These parameters become the new defaults for the next RESET function, power-up reset, or not-ready mode reset (test-reset).

ASCII:	SUB
Program Line:	LPRINT CHR$(26)
Arguments:	None
Argument Values:	None
Default Values:	None

SELECT 10 CHARACTERS PER INCH

This function overrides the setting of Parameter #02 (Characters Per Inch) and causes all data to be printed at 10 characters per inch (cpi). Selecting another pitch (12 or 17.1 cpi) cancels this function.

ASCII:	GS
Program Line:	LPRINT CHR$(29);
Arguments:	None
Argument Values:	None
Default Value:	10 cpi

SELECT 12 CHARACTERS PER INCH

This function overrides the setting of Parameter #02 (Characters Per Inch) and causes all data to be printed at 12 characters per inch (cpi). Selecting another pitch (10 or 17.1 cpi) cancels this function.

ASCII:	RS
Program Line:	LPRINT CHR$(30);
Arguments:	None
Argument Values:	None
Default Value:	10 cpi

SELECT 17.1 CHARACTERS PER INCH

This function overrides the setting of Parameter #02 (Characters Per Inch) and causes all data to be printed at 17.1 characters per inch (cpi). Selecting another pitch (10 or 12 cpi) cancels this function.

ASCII:	US
Program Line:	LPRINT CHR$(31);
Arguments:	None
Argument Values:	None
Default Value:	10 cpi

SELECT UPPER CHARACTER SET

This function selects the upper portion of the character set containing the block graphic symbols. This function is ignored if Parameter #25 (Data Length) is 8. See *Graphics Programming*.

ASCII:	ESC SO
Program Line:	LPRINT CHR$(27);CHR$(14);
Arguments:	None
Argument Values:	None
Default Value:	Lower Character Set

SELECT LOWER CHARACTER SET

This function selects the lower portion of the character set containing the ASCII characters. This function is ignored if Parameter #25 (Data Length) is 8. See *Graphics Programming*.

ASCII:	ESC SI
Program Line:	LPRINT CHR$(27);CHR$(15);
Arguments:	None
Argument Values:	None
Default Value:	Lower Character Set

SET VERTICAL ADVANCE-1

This function overrides the setting of Parameter #08 (Vertical Advance-1) and sets the vertical advance in 48 increments per inch (144 increments per inch if Parameter #18, Paper Feed Increments, is set for 144). Using either the VERTICAL ADVANCE-1 WITH CARRIAGE RETURN function or VERTICAL ADVANCE-1 WITHOUT CARRIAGE RETURN function selects the value set by this function.

ASCII:	ESC B
Program Line:	LPRINT CHR$(27);"B,n,$";
Arguments:	1 (n)
Argument Values:	n=1/48 or 1/144 inch vertical increments
Default Value:	8/48

SET VERTICAL ADVANCE-2

This function overrides the setting of Parameter #09 (Vertical Advance-2) and sets the vertical advance in 1/48 inch increments (1/144 inch if Parameter #18, Paper Feed Increments, is set for 144) for subscripting with SUPERSCRIPT/SUBSCRIPT ON function. The VERTICAL ADVANCE-2 WITH CARRIAGE RETURN function or VERTICAL ADVANCE-2 WITHOUT CARRIAGE RETURN function selects the value set by this function.

ASCII:	ESC C
Program Line:	LPRINT CHR$(27);"C,n,$";
Arguments:	1 (n)
Argument Values:	n=1/48 or 1/144 inch vertical increments
Default Value:	4/48 inch

SET VERTICAL ADVANCE-3

This function overrides the setting of Parameter #10 (Vertical Advance-3) and sets the vertical advance in minus 1/48 inch increments (-1/144 inch if Parameter #18, Paper Feed Increments, is set for 144) for superscripting with the SUPERSCRIPT/SUBSCRIPT ON function. The VERTICAL ADVANCE-3 WITHOUT CARRIAGE RETURN function selects the value set by this function.

ASCII:	ESC D
Program Line:	LPRINT CHR$(27);"D,n,$";
Arguments:	1 (n)
Argument Values:	n=-1/48 or 1/144 inch vertical increments
Default Value:	-4/48 inch

SET VERTICAL TABS

This function sets up to eight vertical tabs in 1/48 or 1/144 inch increments, depending on the setting of Parameter #18 (Paper Feed Increments). The VERTICAL TABBING function uses the values set by this function.

Tab distances are set ignoring Parameter #07 (Top Margin). When setting tabs, send the setting(s) in ascending order. Previously set tabs are cancelled when a new tab is entered.

ASCII:	ESC E
Program Line:	LPRINT CHR$(27);"E,n1....n8,$";
Arguments:	1 to 8 (n1 through n8)
Argument Values:	n=1/48 or 1/144 inch increments
Default Value:	No Tabs

CANCEL VERTICAL TABS

This function cancels all vertical tabs set by the SET VERTICAL TABS FUNCTION.

ASCII:	ESC E 0
Program Line:	LPRINT CHR$(27);"E,0,$";
Arguments:	None
Argument Values:	None
Default Value:	Selected

SET HORIZONTAL TABS

This function sets up to twenty-eight horizontal tabs in 1/120 inch increments. The HORIZONTAL TABBING function selects the values set by this function.

Tab distances are set ignoring Parameter #03 (Left Margin). When setting tabs, send the argument values in ascending order. Previously set tabs are cancelled when a new tab is entered.

ASCII:	ESC F
Program Line:	LPRINT CHR$(27);"F,n1....n28,$;"
Arguments:	1 to 28 (n1 through n28)
Argument Values:	n=1/120 inch increments
Default Value:	No Tabs Set

CANCEL HORIZONTAL TABS

This function cancels all horizontal tabs set by the SET HORIZONTAL TABS function.

ASCII:	ESC F 0
Program Line:	LPRINT CHR$(27);"F,0";
Arguments:	None
Argument Values:	None
Default Value:	Selected

ABSOLUTE HORIZONTAL POSITIONING

This function allows positioning of the next printable character in 1/120 inch horizontal increments relative to the hard left margin at zero (0). If the argument exceeds the right-most printable position, the next printable character is positioned at the left-most printable position.

ASCII:	ESC G
Program Line:	LPRINT CHR$(27);"G,n,$";
Arguments:	1 (n)
Argument Values:	n=1/120 inch increments
Default Value:	Zero (0)

VERTICAL PAPER POSITION

This function allows paper to be positioned vertically in 1/48 or 1/144 inch increments (depending on the setting of Parameter #18, Paper Feed Increments) from the current top-of-form position.

ASCII:	ESC H
Program Line:	LPRINT CHR$(27);"H,n,$";
Arguments:	1 (n)
Argument Values:	n=1/48 or 1/144 inch increments
Default Value:	Zero (0)

SET LEFT AND RIGHT MARGINS

This function overrides the settings of Parameter #03 (Left Margin) and Parameter #04 (Right Margin), and sets the left and right margins in reference to the left-most printable position in 1/120 inch increments, based on the current pitch (10, 12, 17.1 cpi) selection. Note that both arguments must be used for this function to operate properly.

This function will not operate if the left and right margins are set closer than 1/2 inch to each other.

ASCII:	ESC J
Program Line:	LPRINT CHR$(27);"J,n1,n2,$";
Arguments:	2 (n1 and n2)
Argument Values:	n1 (left margin) and n2 (right margin)=1/120 inch increments
Default Value:	Left Margin=0; Right Margin=1584

FORM LENGTH

This function overrides the setting of Parameter #05 (Form Length) and Parameter #06 (Available Space) and sets the length of the form and the actual printable space to be used, based on a 1/48 or 1/144 inch increment setting of Parameter #18 (Paper Feed Increments).

The first argument (n1) is the length of the form to be used and must always be larger than the second argument (n2), if present, which is the actual printable space desired.

ASCII:	ESC L
Program Line:	LPRINT CHR$(27);"L,n1,n2n$";
Arguments:	1 or 2 (n1 and n2)
Argument Values:	n1 and n2=1/48 or 1/144 inch increments
Default Value:	11 inches; full form printable

ABSOLUTE LINE POSITIONING

This function moves the print head to any desired line on the form based on the current line spacing setting (Parameter #08 Vertical Advance-1), with the top-most line being zero (0).

ASCII:	ESC M
Program Line:	LPRINT CHR$(27);"M,n,$";
Arguments:	1 (n)
Argument Values:	n=Increments in Lines
Default Value:	None

ABSOLUTE CHARACTER POSITIONING

This function moves the print head to any desired character position on a line based on the current print density with the left-most character being zero (0). If the PROPORTIONAL SPACING function is being used, character positions cannot be counted accurately.

ASCII:	ESC N
Program Line:	LPRINT CHR$(27);"N,n,$";
Arguments:	1 (n)
Argument Values:	n=Increments in Character Positions
Default Value:	None

INTERCHARACTER SPACING

This function allows the programming of intercharacter spacing with the actual increment dependent on the font style and density being used. The argument value (n) is a decimal number of dot placement columns to be added between characters. This function should only be used with the fixed character spacing mode.

ASCII:	ESC P
Program Line:	LPRINT CHR$(27);"P,n,$";
Arguments:	1 (n)
Argument Values:	n=Increments in Dot Placement Columns
Default Value:	Zero (0)

INCREMENTS OF DOT PLACEMENT COLUMNS

Density	Draft	Text	Letter	Turbo
10 CPI	1/180 In.	1/240 In.	1/360 In.	1/180 In.
12 CPI	1/240 In.	1/300 In.	1/420 In.	1/180 In.
17.1 CPI	1/360 In.	1/480 In.	1/720 In.	1/360 In.

SELECT COLORS

This function allows shifting between ribbon bands while using either a black, process, or primary ribbon. To mix colors on a process ribbon with minimal ink contamination, print the lighter color first and then issue a carriage return and select the darker color before repeating the print line. See *Programming for Color Printing* for the argument values to select the various colors.

ASCII:	ESC Q
Program Line:	LPRINT CHR$(27);"Q,n,$";
Arguments:	1 (n)
Argument Values:	n=1 through 5
Default Value:	Auto Shift On

SELECT CHARACTER SET

This function overrides the setting of Parameter #01 (Character Set) and allows the selection of one of several character sets by entering the corresponding argument value in place of n. The character sets and their corresponding argument values are listed below.

ASCII:	ESC R
Program Line:	LPRINT CHR$(27);"R,n,$";
Arguments:	1 (n)
Argument Values:	n=1 through 254
Default Value:	2 (U.S. Draft Quality)

Character Set	Draft Quality	Text Quality	Letter Quality	Turbo Draft
U.S.	2	1	101	102
English 1	4	3	103	104
English 2	6	5	105	106
French	8	7	107	108
Norwegian	10	9	109	110
German	12	11	111	112
Swedish	14	13	113	114
Spanish	16	15	115	116

Also available are optional Courier, Greek Math, General Scientific, Bar Code, and APL character set kits. Information about these optional character sets is included with the kit.

RELATIVE HORIZONTAL POSITIONING

This function allows positioning of the next printable character in 1/120 inch horizontal increments relative to the current character, either left or right.

To program the next printable character to the right of the current character, use a positive argument value. To program the next printable character to the left of the current character, use a negative argument value. If the argument exceeds either the left or right-most printable position, the next printable character is positioned at the left-most printable position. This function ignores Parameters #03 and #04 and can exceed either the left or right margin.

ASCII:	ESC U
Program Line:	LPRINT CHR$(27);"U,n,$";
Arguments:	1 (n)
Argument Values:	n=1/120 inch increments
Default Value:	None

RELATIVE VERTICAL POSITIONING

This function positions paper relative to the base line of the current line being printed. This is done in increments of either 1/48 or 1/144 inch, depending on what Parameter #18, Paper Feed Increments, is set for. The top-of-form position cannot be exceeded when using this function.

To increment down the paper, use a positive argument value. To increment up the paper, use a negative argument value.

ASCII:	ESC V
Program Line:	LPRINT CHR$(27);"V,n,$";
Arguments:	1 (n)
Argument Values:	n=1/48 or 1/144 inch increments
Default Value:	None

PRINT CONTROL CODES

This function is intended to print characters in the decimal 0 to 31 area of the ASCII code chart, but all 256 codes are printed equally. If Parameter #25 (Data Length) is 7, then only the current set of 128 (upper or lower) characters is accessible. The argument (n) is a decimal number that represents the number of printable characters for which this command is in effect.

While printing in this mode, reaching the right margin causes the line feed function, and the following character prints at the left margin. No other functions can be performed when this function is being used.

ASCII:	ESC W
Program Line:	LPRINT CHR$(27);"W,n,$";
Arguments:	1 (n)
Argument Values:	n=number of characters
Default Value:	Not Selected

SELECT RESET MODE

This function overrides the setting of Parameter #21 (Reset Mode) and selects either the "hard" or "soft" mode for the RESET PRINTER function. When in the "hard" mode, the print buffer is cleared of all data received since the last function code. In the "soft" mode, all functions are reset to default and initialization values.

ASCII:	ESC a
Program Line:	LPRINT CHR$(27);"a,n,$";
Arguments:	1 (n)
Argument Values:	n=0 ("Soft" Mode) or 1 ("Hard" Mode)
Default Value:	"Soft" Mode

EMPHASIZED CHARACTERS

This function overrides the setting of Parameter #16 (Emphasized) and selects the emphasized print mode. The characters are printed, the print head is returned and the characters are reprinted with a 1/120 inch horizontal offset.

To turn on emphasized characters, use the following code:

ASCII:	ESC b
Program Line:	LPRINT CHR$(27);"b";
Arguments:	None
Argument Values:	None
Default Value:	Emphasized Characters Off

To turn off emphasized characters, use the following code:

ASCII:	ESC c
Program Line:	LPRINT CHR$(27);"c";
Arguments:	None
Argument Values:	None
Default Value:	None

DOUBLE STRIKE

This function overrides the setting of Parameter #15 (Double Strike) and selects a two-pass mode of print. The characters are printed, the print head is returned and the characters are reprinted with no horizontal or vertical offset. If the character set being used is a letter quality two-pass set, this function causes four passes to occur.

To turn on double strike, use the following code:

ASCII:	ESC d
Program Line:	LPRINT CHR$(27);"d";
Arguments:	None
Argument Values:	None
Default Value:	Double Strike Off

To cancel double strike, use the following code:

ASCII:	ESC e
Program Line:	LPRINT CHR$(27);"e";
Arguments:	None
Argument Values:	None
Default Value:	Double Strike Off

UNDERLINE ON/OFF

This function causes all data following it to be printed with an underline when an argument value of one (1) is selected. Selecting an argument value of zero (0) cancels this function.

ASCII:	ESC f
Program Line:	LPRINT CHR$(27);"f,n,$";
Arguments:	1 (n)
Argument Values:	n=0 (Off) or 1 (On)
Default Value:	Underline Off

UNIDIRECTIONAL/BIDIRECTIONAL PRINTING

This function causes all lines to be printed unidirectionally if the argument value is 1, or bidirectionally if the argument value is 0. When the print mode requires unidirectional printing (such as graphics), this function cannot select bidirectional printing.

ASCII:	ESC g
Program Line:	LPRINT CHR$(27);"g,n,$";
Arguments:	1 (n)
Argument Values:	n = 0 (Bidirectional) or 1 (Unidirectional)
Default Value:	Bidirectional

SUPERSCRIPT/SUBSCRIPT

This function selects printing of one-half height characters for superscript (the upper half of the character cell) or subscript (the lower half of the character cell). The print head makes two passes with an upward paper movement of 1/144 inch between passes. Superscripting and subscripting can be intermixed with normal print on a print line.

To turn on superscript or subscript, use the following code:

ASCII:	ESC h
Program Line:	LPRINT CHR$(27);"h,n,$";
Arguments:	1 (n)
Argument Values:	n=0 (Superscript) or 1 (Subscript)
Default Value:	Superscript/Subscript Off

To turn off superscript or subscript, use the following code:

ASCII:	ESC i
Program Line:	LPRINT CHR$(27);"i";
Arguments:	None
Argument Values:	None
Default Value:	Superscript/Subscript Off

LINE FEED INCREMENTS

This function selects vertical line feed increments of either 1/48 or 1/144 inch spacing for later selection by the Vertical Advance Functions. Current vertical advance values are not affected by this function.

ASCII:	ESC j
Program Line:	LPRINT CHR$(27);"j,n,$";
Arguments:	1 (n)
Argument Values:	n=0 (1/48 Inch Vertical Increments) or 1 (1/144 Inch Vertical Increments)
Default Value:	1/48 Inch Vertical Spacing

GRAPHICS DENSITY

This function selects one of three graphics densities: 84 X 84 dots per inch (dpi), 168 X 84 2-phase dpi or 168 X 84 1-phase dpi. This function is explained in greater detail under graphics programming.

ASCII:	ESC x
Program Line:	LPRINT CHR$(27);"x,n,$";
Arguments:	1 (n)
Argument Values:	n=0 (84 X 84 dpi), 1 (168 X 84 dpi, 2-Phase) or 2 (168 X 84 dpi, 1-Phase)
Default Value:	84 X 84 dpi

6 GRAPHICS PROGRAMMING

The following paragraphs describe block and dot graphics programming for the printer's IBM and P-Series Compatible modes.

7 BLOCK GRAPHICS

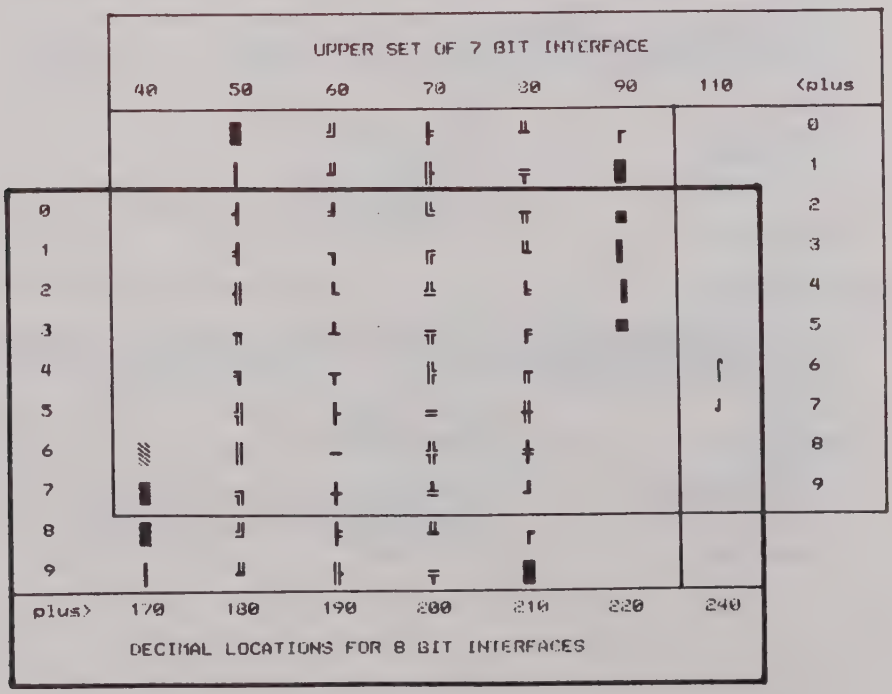
Block graphics mode allows printing of horizontal and vertical borders, boxes, and lines using predefined patterns of blocked print. Alphanumeric characters, character densities, block graphics, and dot graphics can be intermixed within a line.

The symbols are 1/6 inch high with width determined by the selected character density (10, 12, or 17.1 cpi). The symbols can also be printed in expanded (double width) print.

Each symbol is printed with two passes of the print head. The first pass prints the top half of the symbol and the second pass prints the bottom half. Paper is advanced 12/144 inch (1/12th of an inch) between the first and second pass.

To ensure exact positioning of block graphics symbols, set the printer for 6 lines per inch spacing with Parameter #08 (Vertical Advance-1). The block graphic symbols can be positioned anywhere on the paper using the character and line positioning functions described earlier in this appendix.

The block symbols are illustrated in the following chart. To obtain the decimal value of a graphics symbol, add the decimal value at the top of the column that contains the desired symbol to the decimal value in the left column opposite the symbol.



IBM Block Graphics

Program a block graphic by using the appropriate decimal value from the Block Graphic Symbols chart. For example, if a double vertical line is desired, use a program line like the following:

10 LPRINT CHR$(186); (where 176+10=186)

P-Series Block Graphics

NOTE

If Parameter #25 is set for 8 bits, block graphics is identical to the IBM block graphics.

If Parameter #25 (Data Length) is set for seven-bit data then the interface will only pass values of 0 to 127. Before programming block graphics in the P-Series mode, you must select the upper portion of the ASCII character set with the following program line:

10 LPRINT CHR$(27);CHR$(14);

Once in the upper portion of the character set, program a block graphic by using the appropriate decimal value from the Block Graphic Symbols chart. For example, if a double horizontal line is desired, use a program line like the following:

10 LPRINT CHR$(205); (where 192+13=205)

NOTE

You may need to subtract 128 from the above value in order to clear the eighth data bit before the interface does.

If Parameter #25 (Data Length) is set for seven-bit data, use the following program line to leave the upper portion of the character set and return to the lower character set:

10 LPRINT CHR$(27);CHR$(15);

8 DOT GRAPHICS PROGRAMMING

The printer's dot graphics mode allows printing of illustrations, charts, graphs, and block letters using specific patterns of printed dots. By selectively "firing" specific print head wires during each horizontal scan across a page, specific patterns of dots are printed to create the desired graphics image.

Each dot is formed by a 14 mil (1 mil=1/1000 inch) diameter print head wire. The actual dot size varies between 15 and 17 mils due to differences in paper hardness, humidity, and ribbon wear. The dots are printed on 1/82.5 inch centers (approximately 12 mils). All graphics printing is done unidirectionally, left to right.

IBM Dot Graphics Programming

The IBM Compatible mode offers two aspect ratios (1:1 or 5:6) and four selectable graphics densities for each aspect ratio. The 1:1 ratio is used for bit image graphics where high density dot plotting is required. The 5:6 ratio is used for performing a graphics screen "dump" from a computer.

Before beginning graphics programming in the IBM Compatible mode, check the setting of Parameter #18 (IBM Graphics/IBM Color). If IBM Graphics is selected, then the 1:1 aspect ratio is not available. Also, selection of IBM Graphics means that the printer is only compatible with six, seven, or eight pin graphics scans, since vertical dot spacing of 72 dots per inch is not available.

Setting the Printer for IBM Dot Graphics Mode

To set the printer for the dot graphics mode, select, in this order, a graphic line feed, aspect ratio, and a graphics density (Standard, Dual, High, or Double).

Selecting Graphic Line Feed

For seven-bit graphics, select the graphics line feed by using the graphic line feed function to set line spacing to 6/72 inch. The program line for performing this is:

```
10 LPRINT CHR$(27);CHR$(49);
```

For eight-bit graphics, a line feed of 14/144 inch is just smaller than the 8/82.5 dot height, and the slight overlap also avoids a very visible, thin, white line from showing between adjacent graphics passes. The program line for performing this is:

```
10 LPRINT CHR$(27);CHR$(51);CHR$(14);
```

Selecting Aspect Ratio

The aspect ratio can be set for either a 1:1 or 5:6 ratio. The 1:1 aspect ratio is used for bit image graphics for better quality and to make easier bit-position calculations. The 5:6 aspect ratio is used when graphics are printed to duplicate a shape appearing on the display. The program line for selecting an aspect ratio is:

```
20 LPRINT CHR$(27);CHR$(110);CHR$(n);
```

Where argument values for (n) are:

n=0 (Off and 5:6 aspect ratio)
n=1 (On and 1:1 aspect ratio)

Selecting Graphics Density

Once an aspect ratio has been selected, select a graphics density. There are four graphics densities available for use in each aspect ratio. The two bytes (n1 and n2) form a 16-bit counter for the number of graphic data bytes that are to follow. Text mode resumes when the count expires. Each bit of a bit-image data byte is equivalent to a vertical dot for a horizontal position.

The horizontal and vertical graphics densities (in dots per inch) for a 1:1 aspect ratio are:

82.5 X 82.5	Standard Density
165 X 82.5	Dual Density (Half Speed)
165 X 82.5	High Density
330 X 82.5	Double Density (Half Speed)

The horizontal and vertical graphics densities (in dots per inch) for a 5:6 aspect ratio are:

70 X 82.5	Standard Density
140 X 82.5	Dual Density (Half Speed)
140 X 82.5	High Density
280 X 82.5	Double Density (Half Speed)

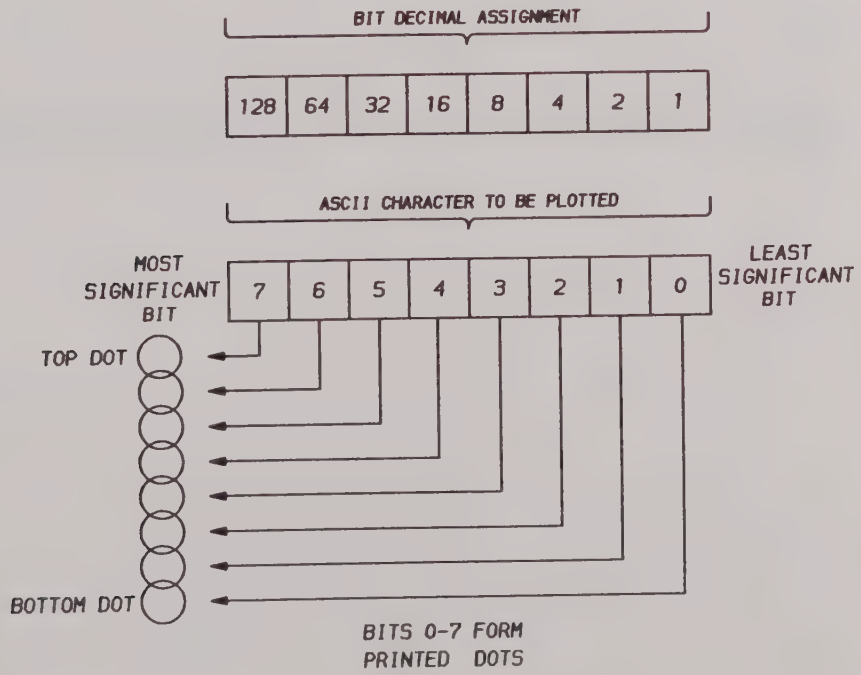
The program lines for selecting graphics density in either aspect ratio are:

Standard Density:	LPRINT CHR$(27);CHR$(75);CHR$(n1);CHR$(n2);
Dual Density:	LPRINT CHR$(27);CHR$(76);CHR$(n1);CHR$(n2);
High Density:	LPRINT CHR$(27);CHR$(89);CHR$(n1);CHR$(n2);
Double Density:	LPRINT CHR$(27);CHR$(90);CHR$(n1);CHR$(n2);

IBM Bit Mapping

Successive characters are printed in adjacent vertical columns. Each print head wire is addressable by one bit of each byte, allowing control over all dots on the page.

All eight bits in each character are used. The most-significant bit (7) controls the top dot, and bit zero controls the bottom dot. A dot is printed only when its corresponding bit is set. See the figure below.



P-Series Dot Graphics Programming

The P-Series Compatible mode offers three graphics resolutions for the printing of illustrations, charts, graphs, and block letters. Before placing the printer in the dot graphics mode, you must select a graphics density.

Selecting a Graphics Density

The three vertical and horizontal graphics densities are 84 by 84 dots per inch (dpi), 168 by 84 (2-phase) dpi, and 168 by 84 (1-phase) dpi. The 1-phase (168 by 84 dpi) mode prints a dot(s) for each bit in the bit stream. The 2-phase (168 by 84 dpi) prints a dot(s) at every other bit in the stream. While in the normal print mode, the following program line selects one of the three graphics densities:

```
10 LPRINT CHR$(27);"x,n,$";
```

The argument values for (n) are as follows:

n=0 (84 X 84 dpi)

n=1 (168 X 84 dpi, 2-phase)

n=2 (168 X 84 dpi, 1-phase)

Note that this program line data will be printed as graphics data if executed while in the dot graphics mode.

If the argument is not a 0,1, or 2, the function is ignored by the printer and the graphics density remains unchanged. If the argument value equals 2, two horizontal dot positions may be specified next to each other, but the second dot is ignored by the printer.

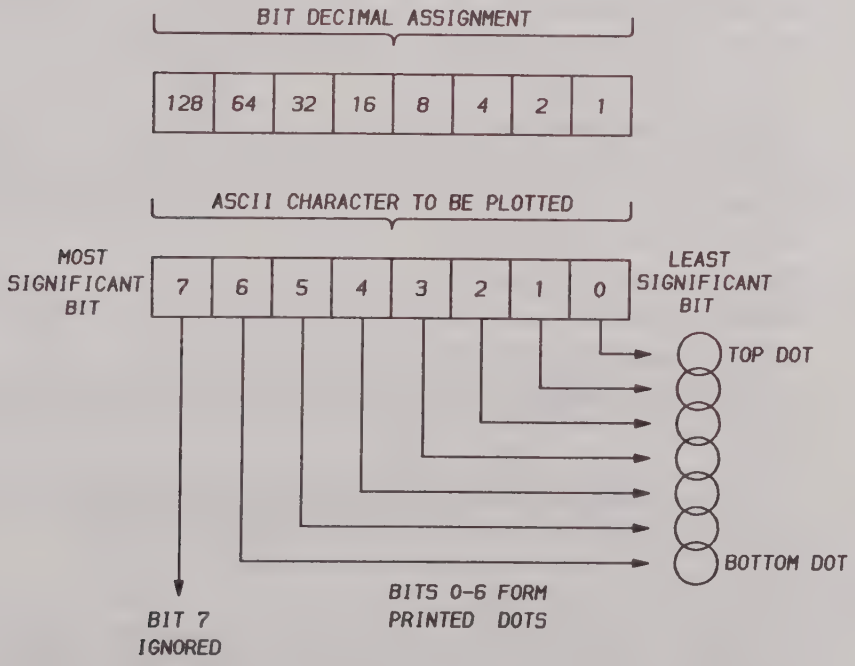
Selecting the Dot Graphics Mode

Once a graphics density is selected, place the printer in the dot graphics mode with the following program line:

LPRINT CHR$(3);

Once in the dot graphics mode, printing of dots to form graphic images is controlled by the setting of bits in each character. Characters received by the printer are printed in a single vertical column about 1/84 inch wide and seven dots high. Successive characters are printed in adjacent vertical columns. Each print head wire is addressable by one bit of each byte, giving total control over all dots on a page.

As shown in the figure below, only the seven least significant bits in each character are used. The least significant bit 0 (zero) controls the top dot and bit 6 controls the bottom dot. A dot is printed only when its corresponding bit is set.



Paper and Print Head Control

When in the dot graphics mode, paper positioning and print head movement are controlled by function codes that are similar to the standard functions described in *P-Series Programming*. However, because the dot graphics mode interprets standard BASIC functions as dot positions, function commands must be input differently in the graphics mode. For example, while in the graphics mode, the program line to perform a Form Feed looks like this:

```
10 LPRINT CHR$(3);CHR$(12);
```

This differs from the previous explanation where the function was programmed in one byte. The table below lists the Dot Graphics Mode Control Codes that must be preceded by a CHR$(3) to avoid being printed as dot data. Note that graphics density must be selected before entering the graphics mode.

DOT GRAPHICS MODE CONTROL CODES REQUIRING THE DECIMAL 3 PREFIX

Printer Function	Decimal Code
Exit Graphics Mode	2
Print 3 as graphics data	3
Horizontal tab to next tab position	9
Carriage return and vertical advance-1	10
Vertical tab to next tab position	11
Form feed to next page	12
Carriage return to same line	13
Carriage return and vertical advance-2	14
Vertical advance-1 w/o carriage return	18
Vertical advance-2 w/o carriage return	20
Vertical advance-3 w/o carriage return	25

Program a Vertical Advance-2 without Carriage Return in graphics mode to achieve the suggested line spacing increment for dot graphics of 12/144 inch. This matches the 7/84 dot height.

Double density graphics (overlapping dots to produce high density graphic images) can be programmed in the dot graphics mode. To do this, one of the vertical advance functions must be programmed in 2/48 inch increments to achieve vertical overlap of 3½ dots per step.

Dot Graphics Considerations

The computer must issue graphics characters exactly as they are sent from the controlling software. Many computers trap special control characters by either deleting or changing them to issue special sequences in place of the actual data sent by the controlling program. This is serious if, for example, the computer attempts to maintain a line length of 40 characters when graphics output consists of 400 characters per line. It is often possible to prevent characters from being trapped by adding decimal 128 (setting the most significant bit of the character) to whatever graphics codes are being sent.

9 PROGRAMMING FOR COLOR PRINTING

This section describes how to program the selection and intermixing of individual colors using the color ribbons available for the printer. A black ribbon is shipped with the printer. Two color ribbon types are available as accessories for the printer: a process ribbon and a primary ribbon.

The process ribbon has four color bands--yellow, magenta, cyan, and black. These colors can be used individually or mixed to produce orange, violet, green and brown.

The primary ribbon has red, green, blue, and black bands. These colors are used individually and are not suited for mixing.

Mixing Color Bands (Process Ribbon Only)

Printing in color should be done with care to prevent ribbon band contamination. If the colors are not programmed in the correct order, band contamination may occur, thus reducing the clear definition of colors on the final product.

To program color and avoid ribbon band contamination, program the lightest color first followed by the next lightest and so on. For example if green is desired using the process ribbon, program yellow first and cyan second. Printing yellow over any other fresh ink will contaminate the yellow ink on the ribbon. Cyan over fresh ink yellow will also be contaminated but less noticeably.

Dithering (Process Ribbon Only)

Dithering or mixing of colors with the process ribbon gives an almost infinite variety of colors to choose from when printing in color. Light colors can be made darker. The eight standard and mixed colors can be made into different variations and shadings by mixing the dot patterns.

Printing in Color

The printer can be programmed through the computer to select any color on a ribbon or several combinations of mixed colors with the process ribbon. Colors can also be changed within a line. To program color:

1. Check that the Ribbon Auto Shift Parameter is off (Parameter #10 for IBM Compatible mode; Parameter #12 for P-Series Compatible mode).

NOTE

If the Ribbon Auto Shift Parameter is On when the color ribbon is installed, an automatic shift of the ribbon band occurs at the next top-of-form. If the application in use can make color selection, selecting a color band overrides the ribbon auto shift parameter.

2. If using the P-Series Compatible mode Parameter #21 (Extended Control Code Set) must be On.

3. Select the argument value or function code from the table on the next page, and send one of the following program lines.

```
LPRINT CHR$(27);CHR$(n); (IBM Compatible mode)
LPRINT CHR$(27);"Q,n,$"; (P-Series Compatible mode)
```

Ribbon Color Argument Values and Function Codes

Ribbon Type	P-Series Compatible Argument Value	IBM Compatible Function Code
Process Ribbon		
Yellow	1	121
Magenta	2	109
Cyan	3	99
Black	4	98
Process Ribbon Color Mixing		
Orange (Yellow & Magenta)	1 and 2	1121 & 09
Violet (Magenta & Cyan)	2 and 3	109 & 99
Green (Yellow & Cyan)	1 and 3	121 & 99
Brown (Magenta & Black)	2 and 4	109 & 98
Primary Ribbon		
Red	1	121
Green	2	109
Blue	3	99
Black	4	98
Black Ribbon		
Automatic Band Shift	5	97

Note that during a self-test operation, the printer automatically changes color at the beginning of each new form and leaves the auto shift function on. Exiting a self-test operation by pressing RESET (whether printing has started or not) reloads all parameters from the non-volatile RAM and selects the bottom (black) band.

If using a black ribbon, the Ribbon Auto shift parameter should be on. This will cause the ribbon to shift to the next band at each new top-of-form and will extend the ribbon-life.

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